2F

**Comprehensive Data Base of
High-Level Nuclear Waste
Glasses - September 1987
Status Report**

Volume 2 - Additional Appendices

**C. H. Kindle
M. R. Kreiter**

December 1987

**Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830**

**Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
by Battelle Memorial Institute**

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PACIFIC NORTHWEST LABORATORY
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BATTELLE MEMORIAL INSTITUTE
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UNITED STATES DEPARTMENT OF ENERGY
under Contract DE-AC06-76RLO 1830

COMPREHENSIVE DATA BASE OF HIGH-LEVEL NUCLEAR
WASTE GLASSES--SEPTEMBER 1987 STATUS REPORT
VOLUME 2 - ADDITIONAL APPENDICES

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M. R. Kreiter

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Pacific Northwest Laboratory
Richland, Washington 99352

PREFACE

The Materials Characterization Center (MCC) at Pacific Northwest Laboratory is assembling a comprehensive data base (CDB) of experimental data collected for high-level nuclear waste package components. The status of the CDB is summarized in Volume I of this report. Volume II contains appendices that present data from the data base and an evaluation of glass durability models applied to the data base.

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APPENDIX B

PRINTOUT OF GLASS THERMAL AND PROCESSING
PROPERTIES DATA BASE

APPENDIX B

PRINTOUT OF GLASS THERMAL AND PROCESSING PROPERTIES DATA BASE

Collected thermal property data for 606 glasses are presented in this appendix. Because of some duplication, 625 entries are listed. Collected data include viscosity, electrical conductivity, and thermal expansion. Blank entries correspond to a lack of data for the particular column heading.

The following printout illustrates the status of the data base. It does not present the data in its final form and is not intended for use at this time.

Abbreviations contained in the printout are explained below:

E.C.	Electrical Conductivity
EC, T100P	Electrical Conductivity at T100P
T30P	Temperature at 30 Poise Viscosity
T100P	Temperature at 100 Poise Viscosity
T(10)4P	Temperature at 10^4 Poise Viscosity
T(10)5P	Temperature at 10^5 Poise Viscosity
T(10)6P	Temperature at 10^6 Poise Viscosity
T(10)7P	Temperature at 10^7 Poise Viscosity
T(10)11P	Temperature at 10^{11} Poise Viscosity
T(10)12P	Temperature at 10^{12} Poise Viscosity

THERMAL PROPERTIES

1 Reference	1 Glass ID or Data Source	2 Al2O3 mol%	3 AlN mol%	4 SiO2 mol%	5 BaO mol%	6 BeO mol%	7 CaO mol%	8 CeO2 mol%	9 Cr2O3 mol%	10 Co2O mol%	11 CuO mol%	12 F mol%
1 BANSAL-R6	Table 13.18	0.00		2.39								
2 BANSAL-R6	Table 13.18	0.00		4.80								
3 BANSAL-R6	Table 13.18	0.00		9.48								
4 BANSAL-R6	Table 13.18	0.00		17.29								
5 BANSAL-R6	Table 13.18	1.69		0.00								
6 BANSAL-R6	Table 13.18	3.34		0.00								
7 BANSAL-R6	Table 13.18	6.73		0.00								
8 BANSAL-R6	Table 13.46					10.00						
9 BANSAL-R6	Table 13.46					15.00						
10 BANSAL-R6	Table 13.46					20.00						
11 BANSAL-R6	Table 13.46					25.00						
12 BANSAL-R6	Table 13.46					30.00						
13 BANSAL-R6	Table 13.49											
14 BANSAL-R6	Table 13.49											
15 BANSAL-R6	Table 13.49											
16 BANSAL-R6	Table 13.49											
17 BANSAL-R6	Table 13.49											
18 BANSAL-R6	Table 13.53											
19 BANSAL-R6	Table 13.53											
20 BANSAL-R6	Table 13.53											
21 BANSAL-R6	Table 13.57											
22 BANSAL-R6	Table 13.57											
23 BANSAL-R6	Table 13.57											
24 BANSAL-R6	Table 13.57											
25 BANSAL-R6	Fig 13.8						0.00					
26 BANSAL-R6	Fig 13.8						5.00					
27 BANSAL-R6	Fig 13.8						10.00					
28 BANSAL-R6	Fig 13.8						15.00					
29 BANSAL-R6	Fig 13.8						0.00					
30 BANSAL-R6	Fig 13.8						5.00					
31 BANSAL-R6	Fig 13.8						10.00					
32 BANSAL-R6	Fig 13.8						15.00					
33 BANSAL-R6	Fig 13.8						0.00					
34 BANSAL-R6	Fig 13.8						5.00					
35 BANSAL-R6	Fig 13.8						10.00					
36 BANSAL-R6	Fig 13.8						15.00					
37 BANSAL-R6	Fig 13.9				5.00							
38 BANSAL-R6	Fig 13.9				10.00							
39 BANSAL-R6	Fig 13.9				15.00							
40 BANSAL-R6	Fig 13.9				0.00							
41 BANSAL-R6	Fig 13.9				5.00							
42 BANSAL-R6	Fig 13.9				10.00							
43 BANSAL-R6	Fig 13.9				15.00							
44 BANSAL-R6	Fig 13.9				0.00							
45 BANSAL-R6	Fig 13.9				5.00							
46 BANSAL-R6	Fig 13.9				10.00							
47 BANSAL-R6	Fig 13.9				15.00							
48 BANSAL-R6	Table 13.67											
49 BANSAL-R6	Table 13.67											
50 BANSAL-R6	Table 13.67											
51 BANSAL-R6	Table 13.67											
52 BANSAL-R6	Table 13.67											

THERMAL PROPERTIES

Reference	13 Fe2O3 mol%	14 Gd2O3 mol%	15 GdO2 mol%	16 K2O mol%	17 Li2O mol%	18 PbO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 w10 mol%
1 BANSAL-H6												
2 BANSAL-H6												
3 BANSAL-H6												
4 BANSAL-H6												
5 BANSAL-H6												
6 BANSAL-H6												
7 BANSAL-H6												
8 BANSAL-H6										15.00		
9 BANSAL-H6										15.00		
10 BANSAL-H6										15.00		
11 BANSAL-H6										15.00		
12 BANSAL-H6										15.00		
13 BANSAL-H6						5.00				15.00		
14 BANSAL-H6						10.00				15.00		
15 BANSAL-H6						15.00				15.00		
16 BANSAL-H6						20.00				15.00		
17 BANSAL-H6						25.00				15.00		
18 BANSAL-H6										15.00		
19 BANSAL-H6										15.00		
20 BANSAL-H6										15.00		
21 BANSAL-H6										15.00		
22 BANSAL-H6										15.00		
23 BANSAL-H6										15.00		
24 BANSAL-H6										15.00		
25 BANSAL-H6				20.00								
26 BANSAL-H6				20.00								
27 BANSAL-H6				20.00								
28 BANSAL-H6				20.00								
29 BANSAL-H6				25.00								
30 BANSAL-H6				25.00								
31 BANSAL-H6				25.00								
32 BANSAL-H6				25.00								
33 BANSAL-H6				30.00								
34 BANSAL-H6				30.00								
35 BANSAL-H6				30.00								
36 BANSAL-H6				30.00								
37 BANSAL-H6				15.00								
38 BANSAL-H6				15.00								
39 BANSAL-H6				15.00								
40 BANSAL-H6				20.00								
41 BANSAL-H6				20.00								
42 BANSAL-H6				20.00								
43 BANSAL-H6				20.00								
44 BANSAL-H6				30.00								
45 BANSAL-H6				30.00								
46 BANSAL-H6				30.00								
47 BANSAL-H6				30.00								
48 BANSAL-H6				1.70								
49 BANSAL-H6				2.80								
50 BANSAL-H6				5.00								
51 BANSAL-H6				6.70								
52 BANSAL-H6				7.70								

THERMAL PROPERTIES

Reference	25 P2H5 mol%	26 PbO mol%	27 PdO mol%	28 Pb2O mol%	29 Pb2O3 mol%	30 RuO2 mol%	31 SO3 mol%	32 SiO2 mol%	33 SrO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
1 BANSAL-R6								97.61				
2 BANSAL-R6								95.20				
3 BANSAL-R6								90.52				
4 BANSAL-R6								82.71				
5 BANSAL-R6								98.31				
6 BANSAL-R6								96.66				
7 BANSAL-R6								93.27				
8 BANSAL-R6								75.00				
9 BANSAL-R6								70.00				
10 BANSAL-R6								65.00				
11 BANSAL-R6								60.00				
12 BANSAL-R6								55.00				
13 BANSAL-R6								80.00				
14 BANSAL-R6								75.00				
15 BANSAL-R6								70.00				
16 BANSAL-R6								65.00				
17 BANSAL-R6								60.00				
18 BANSAL-R6								75.00	10.00			
19 BANSAL-R6								70.00	15.00			
20 BANSAL-R6								65.00	20.00			
21 BANSAL-R6								75.00				
22 BANSAL-R6								70.00				
23 BANSAL-R6								65.00				
24 BANSAL-R6								60.00				
25 BANSAL-R6								80.00				
26 BANSAL-R6								75.00				
27 BANSAL-R6								70.00				
28 BANSAL-R6								65.00				
29 BANSAL-R6								75.00				
30 BANSAL-R6								70.00				
31 BANSAL-R6								65.00				
32 BANSAL-R6								60.00				
33 BANSAL-R6								70.00				
34 BANSAL-R6								65.00				
35 BANSAL-R6								60.00				
36 BANSAL-R6								55.00				
37 BANSAL-R6								80.00				
38 BANSAL-R6								75.00				
39 BANSAL-R6								70.00				
40 BANSAL-R6								80.00				
41 BANSAL-R6								75.00				
42 BANSAL-R6								70.00				
43 BANSAL-R6								65.00				
44 BANSAL-R6								70.00				
45 BANSAL-R6								65.00				
46 BANSAL-R6								60.00				
47 BANSAL-R6								55.00				
48 BANSAL-R6		45.80						52.50				
49 BANSAL-R6		43.00						54.20				
50 BANSAL-R6		37.50						57.50				
51 BANSAL-R6		33.30						60.00				
52 BANSAL-R6		30.80						61.50				

THERMAL PROPERTIES

Reference	37 U3H8 mol%	38 H2O2 mol%	39 H2O3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZnO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
1 BANSAL-H6							100.00			1.41e-05
2 BANSAL-H6							100.00			6.92e-06
3 BANSAL-H6							100.00			8.32e-06
4 BANSAL-H6							100.00			1.51e-05
5 BANSAL-H6							100.00			5.13e-05
6 BANSAL-H6							100.00			7.08e-05
7 BANSAL-H6							100.00			9.55e-05
8 BANSAL-H6							100.00		1.05e-01	
9 BANSAL-H6							100.00		1.02e-01	
10 BANSAL-H6							100.00		8.71e-02	
11 BANSAL-H6							100.00		1.07e-01	
12 BANSAL-H6							100.00		1.05e-01	
13 BANSAL-H6							100.00		8.91e-02	
14 BANSAL-H6							100.00		1.17e-01	
15 BANSAL-H6							100.00		1.35e-01	
16 BANSAL-H6							100.00		1.48e-01	
17 BANSAL-H6							100.00		1.35e-01	
18 BANSAL-H6							100.00		6.03e-02	
19 BANSAL-H6							100.00		6.46e-02	
20 BANSAL-H6							100.00		4.79e-02	
21 BANSAL-H6					10.00		100.00		1.70e-01	
22 BANSAL-H6					15.00		100.00		1.70e-01	
23 BANSAL-H6					20.00		100.00		1.48e-01	
24 BANSAL-H6					25.00		100.00		1.51e-01	
25 BANSAL-H6							100.00			1.78e-01
26 BANSAL-H6							100.00			1.66e-01
27 BANSAL-H6							100.00			1.35e-01
28 BANSAL-H6							100.00			7.24e-02
29 BANSAL-H6							100.00			3.16e-01
30 BANSAL-H6							100.00			2.82e-01
31 BANSAL-H6							100.00			2.00e-01
32 BANSAL-H6							100.00			1.66e-01
33 BANSAL-H6							100.00			4.47e-01
34 BANSAL-H6							100.00			3.98e-01
35 BANSAL-H6							100.00			3.55e-01
36 BANSAL-H6							100.00			2.82e-01
37 BANSAL-H6							100.00			5.62e-02
38 BANSAL-H6							100.00			3.55e-02
39 BANSAL-H6							100.00			1.58e-02
40 BANSAL-H6							100.00			1.58e-01
41 BANSAL-H6							100.00			1.26e-01
42 BANSAL-H6							100.00			1.12e-01
43 BANSAL-H6							100.00			6.31e-02
44 BANSAL-H6							100.00			2.51e-01
45 BANSAL-H6							100.00			2.00e-01
46 BANSAL-H6							100.00			1.26e-01
47 BANSAL-H6							100.00			8.91e-02
48 BANSAL-H6							100.00		2.09e-01	
49 BANSAL-H6							100.00		2.04e-01	
50 BANSAL-H6							100.00		2.88e-02	
51 BANSAL-H6							100.00		1.78e-02	
52 BANSAL-H6							100.00		1.91e-02	

THERMAL PROPERTIES

Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
1 BANSAL-H6			3.98e-05		9.55e-05	1.74e-04	2.75e-04
2 BANSAL-H6			2.75e-05		5.01e-05	7.94e-05	1.15e-04
3 BANSAL-H6			2.04e-05		3.98e-05	6.92e-05	1.05e-04
4 BANSAL-H6			3.31e-05		6.03e-05	1.00e-04	1.45e-04
5 BANSAL-H6			1.15e-04		2.14e-04	3.47e-04	5.25e-04
6 BANSAL-H6			1.74e-04		2.75e-04	4.37e-04	6.31e-04
7 BANSAL-H6			1.82e-04		3.02e-04	4.57e-04	6.31e-04
8 BANSAL-H6		2.34e-01		3.80e-01			
9 BANSAL-H6		2.34e-01		3.80e-01			
10 BANSAL-H6		2.00e-01		3.31e-01			
11 BANSAL-H6		2.45e-01		4.27e-01			
12 BANSAL-H6		2.51e-01		4.27e-01			
13 BANSAL-H6		1.70e-01		2.75e-01			
14 BANSAL-H6		2.40e-01		3.89e-01			
15 BANSAL-H6		2.82e-01		4.79e-01			
16 BANSAL-H6		3.09e-01		5.13e-01			
17 BANSAL-H6		3.31e-01		5.89e-01			
18 BANSAL-H6		1.41e-01		2.57e-01			
19 BANSAL-H6		1.66e-01		3.31e-01			
20 BANSAL-H6		1.74e-01		3.80e-01			
21 BANSAL-H6		3.63e-01		5.75e-01			
22 BANSAL-H6		3.63e-01		5.75e-01			
23 BANSAL-H6		3.16e-01		5.25e-01			
24 BANSAL-H6		3.98e-01		6.61e-01			
25 BANSAL-H6							
26 BANSAL-H6							
27 BANSAL-H6							
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44 BANSAL-H6							
45 BANSAL-H6							
46 BANSAL-H6							
47 BANSAL-H6							
48 BANSAL-H6		5.89e-01					
49 BANSAL-H6		5.89e-01					
50 BANSAL-H6		1.12e-01		2.82e-01			
51 BANSAL-H6		6.76e-02		1.86e-01			
52 BANSAL-H6		7.41e-02		1.95e-01			

Thermal Properties

[illegible]

THERMAL PROPERTIES

Reference	63 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
1 BANSAL-H6							
2 BANSAL-H6							
3 BANSAL-H6							
4 BANSAL-H6							
5 BANSAL-H6							
6 BANSAL-H6							
7 BANSAL-H6							
8 BANSAL-H6							
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10 BANSAL-H6							
11 BANSAL-H6							
12 BANSAL-H6							
13 BANSAL-H6							
14 BANSAL-H6							
15 BANSAL-H6							
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36 BANSAL-H6							
37 BANSAL-H6							
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46 BANSAL-H6							
47 BANSAL-H6							
48 BANSAL-H6							
49 BANSAL-H6							
50 BANSAL-H6							
51 BANSAL-H6							
52 BANSAL-H6							

THERMAL PROPERTIES

Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc, Poise	74 Other Visc, Poise	75 Other Visc, Poise
1 HANSAL-R6						
2 BANSAL-R6						
3 HANSAL-R6						
4 BANSAL-R6						
5 BANSAL-R6						
6 BANSAL-R6						
7 HANSAL-R6						
8 BANSAL-R6						
9 BANSAL-R6						
10 HANSAL-R6						
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12 HANSAL-R6						
13 BANSAL-R6						
14 HANSAL-R6						
15 BANSAL-R6						
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25 BANSAL-R6						
26 BANSAL-R6						
27 BANSAL-R6						
28 BANSAL-R6						
29 BANSAL-R6						
30 BANSAL-R6						
31 BANSAL-R6						
32 BANSAL-R6						
33 BANSAL-R6						
34 BANSAL-R6						
35 BANSAL-R6						
36 BANSAL-R6						
37 BANSAL-R6						
38 BANSAL-R6						
39 BANSAL-R6						
40 BANSAL-R6						
41 BANSAL-R6						
42 HANSAL-R6						
43 BANSAL-R6						
44 BANSAL-R6						
45 BANSAL-R6						
46 BANSAL-R6						
47 BANSAL-R6						
48 BANSAL-R6						
49 BANSAL-R6						
50 BANSAL-R6						
51 BANSAL-R6						
52 BANSAL-R6						

THERMAL PROPERTIES

Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
1 BANSAL-H6						
2 BANSAL-H6						
3 BANSAL-H6						
4 BANSAL-H6						
5 BANSAL-H6						
6 BANSAL-H6						
7 BANSAL-H6						
8 BANSAL-H6						
9 BANSAL-H6						
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18 BANSAL-H6						
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49 BANSAL-H6						
50 BANSAL-H6						
51 BANSAL-H6						
52 BANSAL-H6						

THERMAL PROPERTIES

Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th. Exp. Lin. Coeff.
1 BANSAL-R6				
2 BANSAL-R6				
3 BANSAL-R6				
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48 BANSAL-R6				
49 BANSAL-R6				
50 BANSAL-R6				
51 BANSAL-R6				
52 BANSAL-R6				

THERMAL PROPERTIES

1 Reference	1 Glass ID or Data Source	2 Al ₂ O ₃ mol%	3 AlN mol%	4 B ₂ O ₃ mol%	5 BaO mol%	6 BaO mol%	7 CaO mol%	8 CaO ₂ mol%	9 Cr ₂ O ₃ mol%	10 CaF ₂ mol%	11 CuO mol%	12 F mol%
53 BANSAL-R6	Table 13.67											
54 BANSAL-R6	Table 13.67											
55 BANSAL-R6	Table 13.67											
56 BANSAL-R6	Table 13.67											
57 BANSAL-R6	Table 13.67											
58 BANSAL-R6	Table 13.67											
59 BANSAL-R6	Table 13.67											
60 BANSAL-R6	Table 13.67											
61 BANSAL-R6	Table 13.67											
62 BANSAL-R6	Table 13.67											
63 BANSAL-R6	Table 13.67											
64 BANSAL-R6	Table 13.67											
65 BANSAL-R6	Table 13.67											
66 BANSAL-R6	Table 13.67											
67 BANSAL-R6	Table 13.67											
68 BANSAL-R6	Table 13.67											
69 BANSAL-R6	Table 13.79	6.00										
70 BANSAL-R6	Table 13.79	10.00										
71 BANSAL-R6	Table 13.79	16.00										
72 BANSAL-R6	Table 13.79	20.00										
73 BANSAL-R6	Table 13.79	22.00										
74 BANSAL-R6	Table 13.79	24.00										
75 BANSAL-R6	Table 13.112			5.00	30.00							
76 BANSAL-R6	Table 13.112			12.00	30.00							
77 BANSAL-R6	Table 13.112			15.00	30.00							
78 BANSAL-R6	Table 13.112			18.00	30.00							
79 BANSAL-R6	Table 13.112			20.00	30.00							
80 BANSAL-R6	Table 13.112			25.00	30.00							
81 BANSAL-R6	Table 13.112			30.00	30.00							
82 BANSAL-R6	Table 13.112			40.00	30.00							
83 BANSAL-R6	Table 13.112			50.00	30.00							
84 BANSAL-R6	Table 13.112			60.00	30.00							
85 BANSAL-R6	Table 13.112			15.00	35.00							
86 BANSAL-R6	Table 13.112			20.00	35.00							
87 BANSAL-R6	Table 13.112			5.00	40.00							
88 BANSAL-R6	Table 13.112			10.00	40.00							
89 BANSAL-R6	Table 13.112			55.00	40.00							
90 BANSAL-R6	Table 13.123	2.79		2.76								
91 BANSAL-R6	Table 13.123	5.47		5.46								
92 BANSAL-R6	Table 13.123	11.45		5.47								
93 BANSAL-R6	Table 13.123	14.27		5.38								
94 BANSAL-R6	Table 13.123	10.85		9.06								
95 BANSAL-R6	Table 13.123	8.90		10.84								
96 BANSAL-R6	Table 13.123	5.53		11.87								
97 BANSAL-R6	Table 13.123	5.49		14.27								
98 CHICK-B0	79-339	4.10		10.50			1.20					
99 CHICK-B0	TDS + 79-339	3.90		10.00			1.20			0.20		
100 CHICK-B0	TDS/211	2.10		7.70			6.00			0.20		
101 CHICK-B0	RHO Purex	3.50		9.80			1.00					
102 CHICK-B0	RHO Res. Lin.	4.20		9.20					0.10	0.10		
103 CHICK-B0	76-68			10.60			2.80		0.20	0.30		
104 CHICK-B0	77-260	1.60		10.70			1.50			0.20	3.20	

THERMAL PROPERTIES

Reference	13 Fe2O3 mol%	14 Ga2O3 mol%	15 GeO2 mol%	16 K2O mol%	17 Li2O mol%	18 NaO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
53 BANSAL-R6				9.00								
54 BANSAL-R6				10.00								
55 BANSAL-R6				10.00								
56 BANSAL-R6				10.00								
57 BANSAL-R6				10.00								
58 BANSAL-R6				10.00								
59 BANSAL-R6				10.00								
60 BANSAL-R6				11.00								
61 BANSAL-R6				13.30								
62 BANSAL-R6				18.00								
63 BANSAL-R6				20.00								
64 BANSAL-R6				20.00								
65 BANSAL-R6				20.00								
66 BANSAL-R6				20.00								
67 BANSAL-R6				30.00								
68 BANSAL-R6				30.00								
69 BANSAL-R6										20.00		
70 BANSAL-R6										20.00		
71 BANSAL-R6										20.00		
72 BANSAL-R6										20.00		
73 BANSAL-R6										20.00		
74 BANSAL-R6										20.00		
75 BANSAL-R6												
76 BANSAL-R6												
77 BANSAL-R6												
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93 BANSAL-R6												
94 BANSAL-R6												
95 BANSAL-R6												
96 BANSAL-R6												
97 BANSAL-R6												
98 CHICK-80								1.10		10.80		
99 CHICK-80	6.30							3.10		10.10		1.70
100 CHICK-80	6.00				7.10			2.90		16.30		1.60
101 CHICK-80	5.40				10.90			0.90		10.70		
102 CHICK-80					4.30					10.90		
103 CHICK-80	0.80						3.60		1.00	15.70		0.20
104 CHICK-80	0.60	2.40		1.80			4.60	0.10	0.90	15.00		

THERMAL PROPERTIES

Reference	25 H2O5 mol%	26 PbO mol%	27 PbO mol%	28 Pb2O mol%	29 Pb2O3 mol%	30 PbO2 mol%	31 SnO mol%	32 SiO2 mol%	33 SnO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
53 BANSAL-H6		27.50						63.50				
54 BANSAL-H6		10.00						80.00				
55 BANSAL-H6		20.00						70.00				
56 BANSAL-H6		25.00						65.00				
57 BANSAL-H6		30.00						60.00				
58 BANSAL-H6		40.00						50.00				
59 BANSAL-H6		50.00						40.00				
60 BANSAL-H6		22.50						66.50				
61 BANSAL-H6		16.70						70.00				
62 BANSAL-H6		5.00						77.00				
63 BANSAL-H6		10.00						70.00				
64 BANSAL-H6		20.00						60.00				
65 BANSAL-H6		30.00						50.00				
66 BANSAL-H6		40.00						40.00				
67 BANSAL-H6		10.00						60.00				
68 BANSAL-H6		20.00						50.00				
69 BANSAL-H6								74.00				
70 BANSAL-H6								70.00				
71 BANSAL-H6								64.00				
72 BANSAL-H6								60.00				
73 BANSAL-H6								58.00				
74 BANSAL-H6								56.00				
75 BANSAL-H6								65.00				
76 BANSAL-H6								58.00				
77 BANSAL-H6								55.00				
78 BANSAL-H6								52.00				
79 BANSAL-H6								50.00				
80 BANSAL-H6								45.00				
81 BANSAL-H6								40.00				
82 BANSAL-H6								30.00				
83 BANSAL-H6								20.00				
84 BANSAL-H6								10.00				
85 BANSAL-H6								50.00				
86 BANSAL-H6								45.00				
87 BANSAL-H6								55.00				
88 BANSAL-H6								50.00				
89 BANSAL-H6								5.00				
90 BANSAL-H6								94.45				
91 BANSAL-H6								89.07				
92 BANSAL-H6								83.08				
93 BANSAL-H6								80.35				
94 BANSAL-H6								80.09				
95 BANSAL-H6								80.26				
96 BANSAL-H6								82.60				
97 BANSAL-H6								80.24				
98 CHICK-80								66.00				6.30
99 CHICK-80								63.20	0.30			
100 CHICK-80								49.80	0.30			
101 CHICK-80								57.40	0.40			
102 CHICK-80								67.00				4.20
103 CHICK-80								51.70	0.30			2.90
104 CHICK-80								49.80	0.20			6.30

THERMAL PROPERTIES

Reference	37 U3O8 mol%	38 UO2 mol%	39 UO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZnO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
53 BANSAL-H6							100.00		1.12e-02	
54 BANSAL-H6							100.00		6.76e-03	
55 BANSAL-H6							100.00		1.15e-02	
56 BANSAL-H6							100.00		1.15e-02	
57 BANSAL-H6							100.00		3.09e-02	
58 BANSAL-H6							100.00		1.10e-01	
59 BANSAL-H6							100.00		3.16e-01	
60 BANSAL-H6							100.00		1.23e-02	
61 BANSAL-H6							100.00		1.74e-02	
62 BANSAL-H6							100.00		9.55e-02	
63 BANSAL-H6							100.00		1.26e-01	
64 BANSAL-H6							100.00		1.70e-01	
65 BANSAL-H6							100.00		2.57e-01	
66 BANSAL-H6							100.00		2.88e-01	
67 BANSAL-H6							100.00		4.57e-01	
68 BANSAL-H6							100.00		6.17e-01	
69 BANSAL-H6							100.00		1.12e-01	
70 BANSAL-H6							100.00		1.05e-01	
71 BANSAL-H6							100.00		1.62e-01	
72 BANSAL-H6							100.00		1.82e-01	
73 BANSAL-H6							100.00		1.70e-01	
74 BANSAL-H6							100.00		1.45e-01	
75 BANSAL-H6							100.00			7.76e-04
76 BANSAL-H6							100.00			2.29e-03
77 BANSAL-H6							100.00		3.55e-04	
78 BANSAL-H6							100.00		5.01e-04	
79 BANSAL-H6							100.00		7.94e-04	
80 BANSAL-H6							100.00		1.58e-03	
81 BANSAL-H6							100.00		2.75e-03	
82 BANSAL-H6							100.00		5.50e-03	
83 BANSAL-H6							100.00		1.00e-02	
84 BANSAL-H6							100.00		1.29e-02	
85 BANSAL-H6							100.00			3.98e-02
86 BANSAL-H6							100.00		2.00e-03	
87 BANSAL-H6							100.00			1.05e-02
88 BANSAL-H6							100.00			
89 BANSAL-H6							100.00			
90 BANSAL-H6							99.57			5.13e-05
91 BANSAL-H6							99.64			7.94e-05
92 BANSAL-H6							99.82			6.31e-05
93 BANSAL-H6							99.62			7.59e-05
94 BANSAL-H6							99.66			8.13e-05
95 BANSAL-H6							99.65			7.59e-05
96 BANSAL-H6							99.61			1.26e-04
97 BANSAL-H6							99.59			9.55e-05
98 CHICK-80							100.00			
99 CHICK-80							100.00			
100 CHICK-80							100.00			
101 CHICK-80							100.00			
102 CHICK-80							100.00			
103 CHICK-80					4.80	1.10	100.00			
104 CHICK-80						1.10	100.00			

THERMAL PROPERTIES

Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
53 BANSAL-H6		4.68e-02		1.26e-01			
54 BANSAL-H6		2.34e-02		6.03e-02			
55 BANSAL-H6		4.17e-02		1.12e-01			
56 BANSAL-H6		4.68e-02		1.26e-01			
57 BANSAL-H6		1.07e-01		2.63e-01			
58 BANSAL-H6		3.24e-01					
59 BANSAL-H6							
60 BANSAL-H6		4.47e-02		1.17e-01			
61 BANSAL-H6		5.75e-02		1.35e-01			
62 BANSAL-H6		2.14e-01		3.80e-01			
63 BANSAL-H6		3.24e-01		6.31e-01			
64 BANSAL-H6		4.37e-01		8.71e-01			
65 BANSAL-H6		6.46e-01					
66 BANSAL-H6		7.24e-01					
67 BANSAL-H6		9.55e-01					
68 BANSAL-H6							
69 BANSAL-H6		2.19e-01		4.79e-01			
70 BANSAL-H6		2.95e-01		4.79e-01			
71 BANSAL-H6		2.75e-01		4.79e-01			
72 BANSAL-H6		3.02e-01		4.79e-01			
73 BANSAL-H6		2.75e-01		4.79e-01			
74 BANSAL-H6		2.63e-01		4.79e-01			
75 BANSAL-H6		4.47e-03	1.70e-02				
76 BANSAL-H6		8.13e-03	2.24e-02				
77 BANSAL-H6		1.07e-02	2.82e-02				
78 BANSAL-H6		1.62e-02	3.1e-02				
79 BANSAL-H6		1.82e-02	4.27e-02				
80 BANSAL-H6		2.51e-02	5.50e-02				
81 BANSAL-H6		2.82e-02	6.17e-02				
82 BANSAL-H6		5.25e-02					
83 BANSAL-H6							
84 BANSAL-H6							
85 BANSAL-H6		2.14e-02	5.01e-02				
86 BANSAL-H6		3.02e-02	6.76e-02				
87 BANSAL-H6							
88 BANSAL-H6		2.40e-02	5.62e-02				
89 BANSAL-H6							
90 BANSAL-H6			1.00e-04		2.09e-04	2.88e-04	3.55e-04
91 BANSAL-H6			2.09e-04		2.88e-04	3.47e-04	4.79e-04
92 BANSAL-H6			1.45e-04		2.14e-04	2.88e-04	3.80e-04
93 BANSAL-H6			1.58e-04		2.88e-04	4.57e-04	6.61e-04
94 BANSAL-H6			1.51e-04		2.51e-04	3.72e-04	5.25e-04
95 BANSAL-H6			1.45e-04		2.40e-04	3.55e-04	5.01e-04
96 BANSAL-H6			1.82e-04		2.45e-04	3.02e-04	3.80e-04
97 BANSAL-H6			1.58e-04		2.29e-04	3.02e-04	3.80e-04
98 CHICK-80							
99 CHICK-80							
100 CHICK-80							
101 CHICK-80							
102 CHICK-80							
103 CHICK-80							
104 CHICK-80							

THE THERMAL PROPERTIES

[illegible]

THERMAL PROPERTIES

Reference	63 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
53 BANSAL-H6							
54 BANSAL-H6							
55 BANSAL-H6							
56 BANSAL-H6							
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93 BANSAL-H6							
94 BANSAL-H6							
95 BANSAL-H6							
96 BANSAL-H6							
97 BANSAL-H6							
98 CHICK-B0							
99 CHICK-B0							
100 CHICK-B0							879.00
101 CHICK-B0							8.00
102 CHICK-B0							64.00
103 CHICK-B0							300.00
104 CHICK-B0							20.80

THERMAL PROPERTIES

Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
53 BANSAL-86						
54 BANSAL-86						
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93 BANSAL-86						
94 BANSAL-86						
95 BANSAL-86						
96 BANSAL-86						
97 BANSAL-86						
98 CHICK-80						
99 CHICK-80						
100 CHICK-80						
101 CHICK-80						
102 CHICK-80						
103 CHICK-80						
104 CHICK-80						

THERMAL PROPERTIES

Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
53 BANSAL-H6						
54 BANSAL-H5						
55 BANSAL-H6						
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58 BANSAL-H6						
59 BANSAL-H5						
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70 BANSAL-H5						
71 BANSAL-H6						
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94 BANSAL-H6						
95 BANSAL-H6						
96 BANSAL-H6						
97 BANSAL-H6						
98 CHICK-H0						
99 CHICK-H0						
100 CHICK-H0						
101 CHICK-H0						
102 CHICK-H0						
103 CHICK-H0						
104 CHICK-H0						

THERMAL PROPERTIES

Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th.Exp. Lin.Coeff.
53 BANSAL-Hb				
54 BANSAL-Hb				
55 BANSAL-Hb				
56 BANSAL-Hb				
57 BANSAL-Hb				
58 BANSAL-Hb				
59 BANSAL-Hb				
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62 BANSAL-Hb				
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98 CHICK-B0				
99 CHICK-B0				
100 CHICK-B0				
101 CHICK-B0				
102 CHICK-B0				
103 CHICK-B0				
104 CHICK-B0				

THERMAL PROPERTIES

0 Reference	1 Glass ID or Data Source	2 Al ₂ O ₃ mol%	3 AlN mol%	4 B ₂ O ₃ mol%	5 BaO mol%	6 BaO mol%	7 CaO mol%	8 CaO ₂ mol%	9 Cr ₂ O ₃ mol%	10 Ca ₂ O mol%	11 CuO mol%	12 F mol%
105 CHICK-80	79-417	3.50		10.50			0.40		0.20	0.50		
106 CHICK-80	79-418	4.10		10.50			0.10		0.10	0.20		
107 CHICK-81	#1	1.20		12.50			3.30		2.90			
108 CHICK-81	#2	0.00		13.80			0.00		0.00			
109 CHICK-81	#3	0.00		5.90			13.50		3.10			
110 CHICK-81	#4	0.00		8.80			9.80		2.30			
111 CHICK-81	#5	0.00		8.50			9.60		3.20			
112 CHICK-81	#6	0.00		8.30			9.50		2.90			
113 CHICK-81	#7	14.30		6.10			3.90		3.00			
114 CHICK-81	#8	14.50		12.00			0.00		0.00			
115 CHICK-81	#9	12.60		12.00			0.00		0.00			
116 CHICK-81	#10	0.00		6.50			13.50		0.00			
117 CHICK-81	#11	0.00		11.10			13.70		3.30			
118 CHICK-81	#12	14.70		9.30			12.80		0.00			
119 CHICK-81	#13	5.40		14.40			0.00		3.30			
120 CHICK-81	#14	14.70		6.80			0.00		0.00			
121 CHICK-81	#15	1.40		6.70			0.00		2.70			
122 CHICK-81	#16	4.90		12.90			13.50		3.10			
123 CHICK-81	#17	14.40		5.70			3.10		0.00			
124 CHICK-81	#18	7.10		9.40			6.60		1.50			
125 CHICK-81	#19	7.20		9.50			6.40		1.50			
126 CHICK-81	#20	7.20		8.70			6.40		1.40			
127 CHICK-81	#21	14.20		12.30			0.00		0.00			
128 CHICK-81	#22	0.00		6.30			13.20		0.00			
129 CHICK-81	#23	14.30		12.00			9.60		3.20			
130 CHICK-81	#24	0.00		12.30			9.90		0.00			
131 CHICK-81	#25	14.10		6.10			0.00		2.90			
132 CHICK-81	#26	14.20		6.30			0.00		0.00			
133 CHICK-81	#27	0.00		6.30			13.80		3.00			
134 CHICK-81	#28	0.00		12.00			0.00		3.10			
135 CHICK-81	#29	1.20		6.10			0.00		0.00			
136 CHICK-81	#30	0.00		12.59			9.79		0.00			
137 CHICK-81	#31	0.00		6.40			14.00		2.80			
138 CHICK-81	#32	14.50		6.00			13.90		0.00			
139 CHICK-81	#33	14.40		12.40			13.80		0.00			
140 CHICK-81	#34	0.00		12.00			9.90		0.00			
141 CHICK-81	#35	14.80		11.40			1.20		2.70			
142 CHICK-81	#36	14.50		12.10			1.00		2.90			
143 CHICK-81	#37	14.60		6.00			0.00		0.00			
144 CHICK-81	#38	14.80		5.80			12.70		3.00			
145 CHICK-81	#39	0.00		12.20			13.50		0.00			
146 CHICK-81	#40	0.00		12.30			13.40		0.00			
147 CHICK-81	#41	0.00		6.60			13.40		3.00			
148 CHICK-81	#42	14.50		11.80			0.00		3.10			
149 CHICK-81	#43	7.20		9.20			6.70		1.50			
150 CHICK-81	#44	7.20		9.10			6.60		1.40			
151 CHICK-81	#45	7.20		9.10			6.70		1.40			
152 CHICK-81	#46	0.00		12.50			1.00		3.10			
153 CHICK-81	#47	7.30		6.80			11.70		0.00			
154 CHICK-81	#48	15.50		6.40			4.70		2.80			
155 CHICK-81	#49	0.00		14.10			0.00		0.00			
156 CHICK-81	#50	2.30		12.70			0.00		3.30			

THERMAL PROPERTIES

0 Reference	13 Fe2O3 mol%	14 Ga2O3 mol%	15 GeO2 mol%	16 K2O mol%	17 Li2O mol%	18 MgO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
105 CHICK-80	0.70			0.10			6.70	0.10	2.20	10.60		0.10
106 CHICK-80	6.50						1.90		0.60	11.40		
107 CHICK-81	3.00					0.00				10.40		2.80
108 CHICK-81	0.00					7.40				13.00		1.80
109 CHICK-81	3.10					4.00				15.10		0.00
110 CHICK-81	0.00					7.80				14.40		0.00
111 CHICK-81	0.00					7.90				14.50		0.00
112 CHICK-81	0.00					7.70				15.00		0.00
113 CHICK-81	0.00					7.60				10.60		2.70
114 CHICK-81	2.00					0.00				13.30		2.70
115 CHICK-81	0.00					1.10				15.30		0.00
116 CHICK-81	0.00					2.00				10.30		2.70
117 CHICK-81	3.10					7.90				10.90		0.00
118 CHICK-81	3.10					0.00				15.70		2.60
119 CHICK-81	3.30					3.20				16.40		0.00
120 CHICK-81	0.00					0.00				10.90		0.00
121 CHICK-81	3.00					7.60				14.00		0.00
122 CHICK-81	3.10					0.00				12.80		0.00
123 CHICK-81	0.00					0.00				14.70		0.00
124 CHICK-81	1.50					3.70				12.50		1.40
125 CHICK-81	1.50					3.80				12.60		1.30
126 CHICK-81	1.40					3.80				12.90		1.30
127 CHICK-81	3.00					7.30				10.70		0.00
128 CHICK-81	3.00					0.00				10.70		0.00
129 CHICK-81	0.00					0.00				11.00		0.00
130 CHICK-81	0.00					7.50				15.80		2.80
131 CHICK-81	2.90					7.20				11.40		2.40
132 CHICK-81	2.90					0.00				16.50		2.50
133 CHICK-81	0.00					0.00				15.40		0.00
134 CHICK-81	0.00					0.00				15.30		0.00
135 CHICK-81	2.80					7.90				10.80		0.00
136 CHICK-81	0.90					7.80				15.78		2.80
137 CHICK-81	3.10					0.00				15.90		2.90
138 CHICK-81	0.00					1.30				15.20		0.00
139 CHICK-81	0.00					0.00				10.50		0.00
140 CHICK-81	2.60					8.00				10.10		0.00
141 CHICK-81	2.50					7.70				15.00		0.00
142 CHICK-81	2.90					7.80				16.10		0.00
143 CHICK-81	0.00					7.60				11.10		2.70
144 CHICK-81	2.50					0.00				10.90		0.00
145 CHICK-81	2.50					0.00				11.00		2.80
146 CHICK-81	2.80					0.00				11.20		2.80
147 CHICK-81	0.00					8.00				10.50		2.80
148 CHICK-81	0.00					3.10				10.20		2.70
149 CHICK-81	1.50					3.80				12.50		1.40
150 CHICK-81	1.50					3.90				12.90		1.40
151 CHICK-81	1.50					3.90				12.70		1.40
152 CHICK-81	0.00					3.60				16.30		0.00
153 CHICK-81	2.70					8.40				10.80		2.40
154 CHICK-81	2.20					0.00				15.90		1.90
155 CHICK-81	1.10					0.00				15.60		0.00
156 CHICK-81	0.00					8.60				9.40		0.00

THERMAL PROPERTIES

0 Reference	25 P2O5 mol%	26 PbO mol%	27 PdO mol%	28 Rb2O mol%	29 Rh2O3 mol%	30 RuO2 mol%	31 SO3 mol%	32 SiO2 mol%	33 SrO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
105 CHICK-84								61.40	0.60			
106 CHICK-80								53.70	0.20			
107 CHICK-81								57.80				0.00
108 CHICK-81								57.10				6.90
109 CHICK-81								52.20				0.00
110 CHICK-81								43.70				7.10
111 CHICK-81								43.00				7.10
112 CHICK-81								43.50				7.00
113 CHICK-81								45.80				0.00
114 CHICK-81								48.40				7.10
115 CHICK-81								59.00				0.00
116 CHICK-81								58.80				0.00
117 CHICK-81								43.80				6.20
118 CHICK-81								41.80				8.00
119 CHICK-81								47.30				0.00
120 CHICK-81								59.90				7.70
121 CHICK-81								57.50				7.10
122 CHICK-81								43.40				0.00
123 CHICK-81								53.90				2.10
124 CHICK-81								49.80				3.50
125 CHICK-81								49.70				3.50
126 CHICK-81								49.90				3.40
127 CHICK-81								46.50				0.00
128 CHICK-81								53.80				6.90
129 CHICK-81								42.70				7.20
130 CHICK-81								51.70				0.00
131 CHICK-81								53.00				0.00
132 CHICK-81								44.80				6.90
133 CHICK-81								54.40				7.10
134 CHICK-81								56.50				7.00
135 CHICK-81								58.10				7.00
136 CHICK-81								43.26				6.99
137 CHICK-81								48.60				0.00
138 CHICK-81								42.90				0.00
139 CHICK-81								42.90				0.00
140 CHICK-81								44.30				7.00
141 CHICK-81								44.70				0.00
142 CHICK-81								42.70				0.00
143 CHICK-81								55.00				3.00
144 CHICK-81								43.40				6.90
145 CHICK-81								58.00				0.00
146 CHICK-81								57.50				0.00
147 CHICK-81								49.80				0.00
148 CHICK-81								43.50				5.10
149 CHICK-81								49.60				3.50
150 CHICK-81								49.70				3.40
151 CHICK-81								49.70				3.40
152 CHICK-81								56.50				7.00
153 CHICK-81								42.80				7.10
154 CHICK-81								43.30				7.30
155 CHICK-81								55.00				7.90
156 CHICK-81								57.70				0.00

THERMAL PROPERTIES

0 Reference	37 U3O8 mol%	38 UO2 mol%	39 NO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZrO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
105 CHICK-80					0.20	2.20	100.00			
106 CHICK-80					0.10	0.60	100.00			
107 CHICK-81					6.10		100.00			
108 CHICK-81					0.00		100.00			
109 CHICK-81					3.10		100.00			
110 CHICK-81					6.10		100.00			
111 CHICK-81					6.20		100.00			
112 CHICK-81					6.10		100.00			
113 CHICK-81					6.00		100.00			
114 CHICK-81					0.00		100.00			
115 CHICK-81					0.00		100.00			
116 CHICK-81					6.20		100.00			
117 CHICK-81					0.00		100.00			
118 CHICK-81					0.00		100.00			
119 CHICK-81					6.70		100.00			
120 CHICK-81					0.00		100.00			
121 CHICK-81					0.00		100.00			
122 CHICK-81					6.30		100.00			
123 CHICK-81					6.10		100.00			
124 CHICK-81					3.00		100.00			
125 CHICK-81					3.00		100.00			
126 CHICK-81					3.60		100.00			
127 CHICK-81					6.00		100.00			
128 CHICK-81					6.10		100.00			
129 CHICK-81					0.00		100.00			
130 CHICK-81					0.00		100.00			
131 CHICK-81					0.00		100.00			
132 CHICK-81					5.90		100.00			
133 CHICK-81					0.00		100.00			
134 CHICK-81					6.10		100.00			
135 CHICK-81					6.10		100.00			
136 CHICK-81					0.00		100.00			
137 CHICK-81					6.30		100.00			
138 CHICK-81					6.20		100.00			
139 CHICK-81					6.00		100.00			
140 CHICK-81					6.10		100.00			
141 CHICK-81					0.00		100.00			
142 CHICK-81					0.00		100.00			
143 CHICK-81					0.00		100.00			
144 CHICK-81					0.00		100.00			
145 CHICK-81					0.00		100.00			
146 CHICK-81					0.00		100.00			
147 CHICK-81					5.90		100.00			
148 CHICK-81					6.00		100.00			
149 CHICK-81					3.10		100.00			
150 CHICK-81					2.90		100.00			
151 CHICK-81					3.00		100.00			
152 CHICK-81					0.00		100.00			
153 CHICK-81					0.00		100.00			
154 CHICK-81					0.00		100.00			
155 CHICK-81					6.30		100.00			
156 CHICK-81					6.00		100.00			

THERMAL PROPERTIES

0 Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
105 CHICK-80							
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THERMAL PROPERTIES

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THERMAL PROPERTIES

0 Reference	63 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
105 CHICK-80							
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156 CHICK-81							

THERMAL PROPERTIES

0 Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
105 CHICK-80						
106 CHICK-80						
107 CHICK-81	5800.0					
108 CHICK-81	22.0					
109 CHICK-81	24.0					
110 CHICK-81	13.0					
111 CHICK-81	18.0					
112 CHICK-81	12.0					
113 CHICK-81	5800.0					
114 CHICK-81	740.0					
115 CHICK-81	970.0					
116 CHICK-81	18.0					
117 CHICK-81	60.0					
118 CHICK-81	105.0					
119 CHICK-81	350.0					
120 CHICK-81	5800.0					
121 CHICK-81	470.0					
122 CHICK-81	25.0					
123 CHICK-81	820.0					
124 CHICK-81	330.0					
125 CHICK-81	300.0					
126 CHICK-81	280.0					
127 CHICK-81	960.0					
128 CHICK-81	12.0					
129 CHICK-81	640.0					
130 CHICK-81	5.5					
131 CHICK-81	5800.0					
132 CHICK-81	5800.0					
133 CHICK-81	44.0					
134 CHICK-81	83.0					
135 CHICK-81	77.0					
136 CHICK-81	1.3					
137 CHICK-81	66.0					
138 CHICK-81	82.0					
139 CHICK-81	84.0					
140 CHICK-81	6.2					
141 CHICK-81	5800.0					
142 CHICK-81	5800.0					
143 CHICK-81	1400.0					
144 CHICK-81	495.0					
145 CHICK-81	34.0					
146 CHICK-81	33.0					
147 CHICK-81	68.0					
148 CHICK-81	5800.0					
149 CHICK-81	220.0					
150 CHICK-81	175.0					
151 CHICK-81	243.0					
152 CHICK-81	150.0					
153 CHICK-81	18.0					
154 CHICK-81	808.0					
155 CHICK-81	23.0					
156 CHICK-81	523.0					

THERMAL PROPERTIES

0 Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
105 CHICK-80						
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THERMAL PROPERTIES

0 Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th. Exp. Lin. Coeff.
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THERMAL PROPERTIES

0 Reference	1 Glass ID or Data Source	2 Al ₂ O ₃ mol%	3 AlN mol%	4 B ₂ O ₃ mol%	5 BaO mol%	6 BaF mol%	7 CaO mol%	8 CaF ₂ mol%	9 Cr ₂ O ₃ mol%	10 CaF ₂ mol%	11 CuO mol%	12 F mol%
157 CHICK-81	#51	2.40		12.60			0.00		3.40			
158 CHICK-81	#52	2.30		12.80			0.00		3.20			
159 CHICK-81	#53	0.00		6.80			0.00		0.00			
160 CHICK-81	#54	15.30		6.40			7.20		3.10			
161 CHICK-81	#55	15.20		12.70			1.00		3.10			
162 CHICK-81	#56	3.10		13.30			13.00		0.00			
163 CHICK-81	#57	14.20		6.70			0.00		3.30			
164 CHICK-81	#58	13.80		13.00			0.00		0.00			
165 CHICK-81	#59	0.00		6.60			11.40		3.40			
166 CHICK-81	#60	3.10		6.70			12.80		0.00			
167 CHICK-81	#61	14.20		6.70			12.60		0.00			
168 CHICK-81	#62	14.20		13.40			3.80		0.00			
169 CHICK-81	#63	1.20		13.40			12.90		0.00			
170 CHICK-81	#64	12.70		6.80			13.10		0.00			
171 CHICK-81	#65	13.80		6.70			13.10		0.00			
172 CHICK-81	#66	13.90		6.70			13.20		0.00			
173 CHICK-81	#67	15.10		12.70			1.10		3.00			
174 CHICK-81	#68	14.40		13.30			12.70		3.10			
175 CHICK-81	#69	0.00		6.80			1.10		2.40			
176 CHICK-81	#70	6.20		9.60			7.90		1.50			
177 CHICK-81	#71	5.00		7.20			4.60		1.10			
178 CHICK-81	#72	7.30		5.40			7.00		1.60			
179 CHICK-81	#73	5.80		14.30			5.60		1.30			
180 CHICK-81	#74	0.00		9.50			7.70		1.50			
181 CHICK-81	#75	15.10		7.70			5.00		1.00			
182 CHICK-81	#76	7.90		9.10			0.00		1.80			
183 CHICK-81	#77	5.40		8.20			13.40		1.20			
184 CHICK-81	#78	7.40		8.80			7.10		1.60			
185 CHICK-81	#79	5.90		8.40			5.90		1.30			
186 CHICK-81	#80	7.30		8.80			7.10		1.60			
187 CHICK-81	#81	6.10		8.40			6.00		1.30			
188 CHICK-81	#82	7.10		9.10			6.80		1.60			
189 CHICK-81	#83	6.30		8.50			4.80		1.40			
190 CHICK-81	#84	7.20		9.00			7.00		1.60			
191 CHICK-81	#85	6.10		8.20			5.90		1.40			
192 CHICK-81	#86	7.00		9.00			6.80		0.00			
193 CHICK-81	#87	6.50		7.70			6.20		3.40			
194 CHICK-81	#88	7.00		8.80			6.70		1.50			
195 CHICK-81	#89	6.50		8.60			6.00		1.40			
196 CHICK-81	#90	6.90		9.00			6.60		1.50			
197 CHICK-81	#91	6.40		8.40			6.10		1.40			
198 CHICK-81	#92	14.10		5.10			4.00		0.00			
199 CHICK-81	#93	14.30		5.20			4.00		0.00			
200 CHICK-81	#94	14.30		2.90			4.10		3.50			
201 CHICK-81	#95	16.10		5.40			0.00		0.00			
202 CHICK-81	#96	0.00		12.30			11.40		3.60			
203 CHICK-81	#97	0.00		14.40			2.20		0.00			
204 CHICK-81	#98	0.00		12.80			13.50		3.60			
205 CHICK-81	#99	0.00		11.90			13.80		3.60			
206 CHICK-81	#100	9.90		11.30			4.30		0.00			
207 CHICK-81	#101	0.00		12.50			4.60		0.00			
208 CHICK-81	#102	2.60		9.10			12.50		0.10			

THERMAL PROPERTIES

0 Reference	13 Fe2O3 mol%	14 Ga2O3 mol%	15 GeO2 mol%	16 K2O mol%	17 Li2O mol%	18 MgO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
157 CHICK-81	0.00					7.90				9.30		0.00
158 CHICK-81	0.00					8.20				9.10		0.00
159 CHICK-81	3.10					8.80				14.60		2.70
160 CHICK-81	2.60					0.00				11.30		0.00
161 CHICK-81	0.00					8.00				16.20		2.10
162 CHICK-81	0.00					0.00				14.40		0.00
163 CHICK-81	0.00					0.00				14.50		2.20
164 CHICK-81	0.00					8.30				15.50		0.00
165 CHICK-81	0.00					0.00				10.80		2.70
166 CHICK-81	2.50					0.00				16.50		0.00
167 CHICK-81	0.00					8.30				11.80		0.00
168 CHICK-81	3.00					0.00				9.30		0.00
169 CHICK-81	3.00					8.30				9.60		2.50
170 CHICK-81	0.00					0.00				15.30		2.60
171 CHICK-81	0.00					0.00				14.60		2.60
172 CHICK-81	0.00					0.00				14.90		2.10
173 CHICK-81	0.00					8.00				16.50		2.30
174 CHICK-81	0.00					0.00				11.10		2.40
175 CHICK-81	0.00					0.00				13.60		2.50
176 CHICK-81	1.80					4.50				14.80		1.60
177 CHICK-81	1.10					2.90				11.90		1.10
178 CHICK-81	1.70					4.10				14.10		1.60
179 CHICK-81	1.30					3.40				13.40		1.30
180 CHICK-81	1.80					4.80				14.60		1.70
181 CHICK-81	1.10					2.90				12.30		1.00
182 CHICK-81	1.80					4.60				14.50		1.60
183 CHICK-81	1.20					3.20				13.10		1.30
184 CHICK-81	1.70					0.00				14.30		1.60
185 CHICK-81	1.40					8.80				13.30		1.30
186 CHICK-81	1.60					4.10				9.30		1.50
187 CHICK-81	1.40					3.40				16.80		1.30
188 CHICK-81	1.60					4.10				14.00		1.80
189 CHICK-81	1.40					3.70				13.50		1.40
190 CHICK-81	1.70					4.40				14.30		1.70
191 CHICK-81	1.40					3.60				13.20		1.30
192 CHICK-81	1.60					4.20				14.00		1.50
193 CHICK-81	1.40					3.60				12.80		1.40
194 CHICK-81	0.00					4.00				13.70		1.50
195 CHICK-81	3.40					3.90				14.20		1.40
196 CHICK-81	1.50					3.90				13.90		0.00
197 CHICK-81	1.50					3.80				13.50		3.40
198 CHICK-81	3.50					0.00				9.90		3.40
199 CHICK-81	0.00					0.00				10.20		0.00
200 CHICK-81	0.00					0.00				9.90		0.00
201 CHICK-81	0.00					0.00				16.10		3.00
202 CHICK-81	3.40					0.00				10.20		3.30
203 CHICK-81	3.90					9.60				17.40		0.00
204 CHICK-81	0.00					8.90				10.10		3.40
205 CHICK-81	3.50					0.00				17.10		1.50
206 CHICK-81	0.00					0.00				13.20		0.00
207 CHICK-81	3.40					0.00				14.10		0.00
208 CHICK-81	2.10					6.20				13.90		0.00

THERMAL PROPERTIES

0 Reference	25 P2O5 mol%	26 PbO mol%	27 PdO mol%	28 Rb2O mol%	29 Rh2O3 mol%	30 RuO2 mol%	31 SO3 mol%	32 SiO2 mol%	33 SrO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
157 CHICK-81								58.60				0.00
158 CHICK-81								58.50				0.00
159 CHICK-81								57.90				0.00
160 CHICK-81								54.10				0.00
161 CHICK-81								41.70				0.00
162 CHICK-81								42.90				7.40
163 CHICK-81								45.40				7.70
164 CHICK-81								42.00				7.40
165 CHICK-81								57.40				7.70
166 CHICK-81								58.40				0.00
167 CHICK-81								46.40				0.00
168 CHICK-81								43.30				7.20
169 CHICK-81								43.20				0.00
170 CHICK-81								43.40				0.00
171 CHICK-81								43.20				0.00
172 CHICK-81								43.10				0.00
173 CHICK-81								41.30				0.00
174 CHICK-81								43.00				0.00
175 CHICK-81								59.60				7.70
176 CHICK-81								42.10				4.60
177 CHICK-81								60.20				2.80
178 CHICK-81								49.90				4.10
179 CHICK-81								47.90				3.20
180 CHICK-81								50.60				4.40
181 CHICK-81								48.60				3.10
182 CHICK-81								50.60				4.60
183 CHICK-81								47.30				3.40
184 CHICK-81								50.30				4.10
185 CHICK-81								47.80				1.30
186 CHICK-81								51.00				4.50
187 CHICK-81								49.20				3.50
188 CHICK-81								49.90				4.00
189 CHICK-81								49.30				3.50
190 CHICK-81								49.90				0.00
191 CHICK-81								48.20				8.00
192 CHICK-81								49.00				3.90
193 CHICK-81								50.30				3.90
194 CHICK-81								49.90				3.90
195 CHICK-81								48.20				3.60
196 CHICK-81								49.90				3.90
197 CHICK-81								49.00				3.70
198 CHICK-81								60.00				0.00
199 CHICK-81								59.00				7.30
200 CHICK-81								61.60				3.70
201 CHICK-81								59.40				0.00
202 CHICK-81								41.50				7.90
203 CHICK-81								45.40				0.00
204 CHICK-81								40.70				7.00
205 CHICK-81								42.10				0.00
206 CHICK-81								56.20				0.00
207 CHICK-81								59.90				0.00
208 CHICK-81								45.00				5.80

THERMAL PROPERTIES

Reference	37 U3O8 mol%	38 UO2 mol%	39 WO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZnO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
157 CHICK-81					5.80		100.00			
158 CHICK-81					5.90		100.00			
159 CHICK-81					6.10		100.00			
160 CHICK-81					0.00		100.00			
161 CHICK-81					6.00		100.00			
162 CHICK-81					5.90		100.00			
163 CHICK-81					6.00		100.00			
164 CHICK-81					0.00		100.00			
165 CHICK-81					0.00		100.00			
166 CHICK-81					0.00		100.00			
167 CHICK-81					0.00		100.00			
168 CHICK-81					5.80		100.00			
169 CHICK-81					5.90		100.00			
170 CHICK-81					6.10		100.00			
171 CHICK-81					6.00		100.00			
172 CHICK-81					6.10		100.00			
173 CHICK-81					0.00		100.00			
174 CHICK-81					0.00		100.00			
175 CHICK-81					6.30		100.00			
176 CHICK-81					3.40		100.00			
177 CHICK-81					2.10		100.00			
178 CHICK-81					3.20		100.00			
179 CHICK-81					2.50		100.00			
180 CHICK-81					3.40		100.00			
181 CHICK-81					2.20		100.00			
182 CHICK-81					3.50		100.00			
183 CHICK-81					2.30		100.00			
184 CHICK-81					3.10		100.00			
185 CHICK-81					2.60		100.00			
186 CHICK-81					3.20		100.00			
187 CHICK-81					2.60		100.00			
188 CHICK-81					0.00		100.00			
189 CHICK-81					6.20		100.00			
190 CHICK-81					3.20		100.00			
191 CHICK-81					2.70		100.00			
192 CHICK-81					3.00		100.00			
193 CHICK-81					2.80		100.00			
194 CHICK-81					3.00		100.00			
195 CHICK-81					2.80		100.00			
196 CHICK-81					2.90		100.00			
197 CHICK-81					2.80		100.00			
198 CHICK-81					0.00		100.00			
199 CHICK-81					0.00		100.00			
200 CHICK-81					0.00		100.00			
201 CHICK-81					0.00		100.00			
202 CHICK-81					6.40		100.00			
203 CHICK-81					7.10		100.00			
204 CHICK-81					0.00		100.00			
205 CHICK-81					6.50		100.00			
206 CHICK-81					5.10		100.00			
207 CHICK-81					5.50		100.00			
208 CHICK-81					2.70		100.00			

THERMAL PROPERTIES

0 Reference	47 EC, 1150 C $\delta h_m, cm^{-1}$	48 EC, 1200 C $\delta h_m, cm^{-1}$	49 EC, 1300 C $\delta h_m, cm^{-1}$	50 EC, 1400 C $\delta h_m, cm^{-1}$	51 EC, 1500 C $\delta h_m, cm^{-1}$	52 EC, 1700 C $\delta h_m, cm^{-1}$	53 EC, 1900 C $\delta h_m, cm^{-1}$
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THERMAL PROPERTIES

0 Reference	63 T(10)11P °C	64 T(10)12P °C	65 T(10)13P °C	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
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THERMAL PROPERTIES

0 Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
157 CHICK-81	600.0					
158 CHICK-81	350.0					
159 CHICK-81	13.0					
160 CHICK-81	5800.0					
161 CHICK-81	585.0					
162 CHICK-81	3.9					
163 CHICK-81	5800.0					
164 CHICK-81	74.0					
165 CHICK-81	293.0					
166 CHICK-81	37.0					
167 CHICK-81	130.0					
168 CHICK-81	90.0					
169 CHICK-81	9.0					
170 CHICK-81	51.0					
171 CHICK-81	68.0					
172 CHICK-81	57.0					
173 CHICK-81	680.0					
174 CHICK-81	520.0					
175 CHICK-81	150.0					
176 CHICK-81	115.0					
177 CHICK-81	230.0					
178 CHICK-81	250.0					
179 CHICK-81	61.0					
180 CHICK-81	46.0					
181 CHICK-81	590.0					
182 CHICK-81	720.0					
183 CHICK-81	28.0					
184 CHICK-81	180.0					
185 CHICK-81	130.0					
186 CHICK-81	350.0					
187 CHICK-81	70.0					
188 CHICK-81	100.0					
189 CHICK-81	140.0					
190 CHICK-81	150.0					
191 CHICK-81	82.0					
192 CHICK-81	27.0					
193 CHICK-81	430.0					
194 CHICK-81	86.0					
195 CHICK-81	210.0					
196 CHICK-81						
197 CHICK-81	61.0					
198 CHICK-81	640.0					
199 CHICK-81	1800.0					
200 CHICK-81						
201 CHICK-81	2300.0					
202 CHICK-81	190.0					
203 CHICK-81	1.3					
204 CHICK-81	40.0					
205 CHICK-81	110.0					
206 CHICK-81	160.0					
207 CHICK-81	16.0					
208 CHICK-81	4.5					

THERMAL PROPERTIES

0 Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
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THERMAL PROPERTIES

0 Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th.Exp. Lin.Coeff.
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208 CHICK-81				

THERMAL PROPERTIES

0 Reference	1 Glass ID or Data Source	2 Al ₂ O ₃ mol%	3 AlN mol%	4 H ₂ O ₃ mol%	5 BaO mol%	6 BaO mol%	7 CaO mol%	8 CaO ₂ mol%	9 Cr ₂ O ₃ mol%	10 CaO mol%	11 CuO mol%	12 F mol%
209 CHICK-84	01-09	0.70		0.00			0.48	0.00	0.00	0.00		
210 CHICK-84	02-38	2.21		20.07			5.83	0.03	0.21	0.02		
211 CHICK-84	03-15	1.09		0.00			0.46	0.12	0.85	0.09		
212 CHICK-84	04-44	6.01		7.68			7.37	0.04	0.25	0.03		
213 CHICK-84	05-40	2.31		8.18			6.18	0.04	0.27	0.03		
214 CHICK-84	06-71	7.99		0.00			17.89	0.00	0.00	0.00		
215 CHICK-84	07-34	3.07		8.40			7.75	0.04	0.28	0.03		
216 CHICK-84	08-52	3.75		10.74			1.49	8.80	0.80	0.00		
217 CHICK-84	09-03	5.61		0.00			0.00	0.00	0.00	0.00		
218 CHICK-84	10-30	0.46		0.00			18.32	0.00	0.00	0.00		
219 CHICK-84	11-57	3.13		9.51			0.27	8.18	0.73	0.08		
220 CHICK-84	12-65	0.51		11.28			0.00	0.00	0.00	0.00		
221 CHICK-84	13-60	0.66		9.37			2.91	0.06	0.38	0.04		
222 CHICK-84	14-67	0.68		8.58			0.80	0.80	0.80	0.00		
223 CHICK-84	15-74	9.05		22.78			0.00	0.00	0.00	0.00		
224 CHICK-84	16-58	0.69		7.20			18.90	0.00	0.00	0.00		
225 CHICK-84	17-21	0.57		11.51			0.28	0.80	0.80	0.00		
226 CHICK-84	18-69	9.43		0.00			0.40	0.11	0.77	0.08		
227 CHICK-84	19-73	9.18		15.72			12.65	0.11	0.76	0.08		
228 CHICK-84	20-22	0.78		0.00			0.83	0.06	0.40	0.04		
229 CHICK-84	21-36	1.90		4.89			4.99	0.03	0.19	0.02		
230 CHICK-84	22-27	5.21		18.28			0.54	0.00	0.00	0.00		
231 CHICK-84	23-61	0.65		6.63			1.69	0.06	0.39	0.04		
232 CHICK-84	24-41	3.49		9.40			0.76	0.05	0.34	0.04		
233 CHICK-84	25-64	7.93		10.77			0.48	0.00	0.00	0.00		
234 CHICK-84	26-10	0.41		18.01			0.23	0.00	0.00	0.00		
235 CHICK-84	27-02	5.16		0.00			0.24	0.00	0.00	0.00		
236 CHICK-84	28-45	3.28		9.31			9.39	0.04	0.30	0.03		
237 CHICK-84	29-37	3.60		0.00			9.59	0.05	0.31	0.03		
238 CHICK-84	30-14	6.23		0.00			19.92	0.11	0.75	0.08		
239 CHICK-84	31-01	4.94		0.00			16.49	0.00	0.00	0.00		
240 CHICK-84	32-70	9.42		21.79			0.29	0.11	0.76	0.08		
241 CHICK-84	33-06	5.24		17.72			0.16	0.00	0.00	0.00		
242 CHICK-84	34-18	6.22		21.43			0.27	0.11	0.74	0.08		
243 CHICK-84	35-35	3.75		10.41			9.97	0.05	0.32	0.03		
244 CHICK-84	36-19	6.39		0.00			0.34	0.00	0.00	0.00		
245 CHICK-84	37-31	0.27		0.00			19.03	0.10	0.73	0.08		
246 CHICK-84	38-53	0.41		0.00			0.20	0.02	0.16	0.02		
247 CHICK-84	39-59	8.18		0.00			16.43	0.03	0.18	0.02		
248 CHICK-84	40-47	3.30		9.10			9.18	0.00	0.00	0.00		
249 CHICK-84	41-63	8.27		9.40			1.44	0.00	0.00	0.00		
250 CHICK-84	42-38	3.02		8.04			7.80	0.04	0.26	0.03		
251 CHICK-84	43-11	4.54		0.00			0.40	0.11	0.74	0.08		
252 CHICK-84	44-23	0.68		0.00			0.22	0.11	0.79	0.09		
253 CHICK-84	45-17	5.93		0.00			0.09	0.11	0.76	0.08		
254 CHICK-84	46-56	7.16		0.00			11.54	0.07	0.52	0.06		
255 CHICK-84	47-04	0.28		6.04			0.19	0.10	0.67	0.07		
256 CHICK-84	48-32	6.63		0.00			0.59	0.11	0.79	0.09		
257 CHICK-84	49-13	0.17		17.69			16.55	0.00	0.00	0.00		
258 CHICK-84	50-05	0.71		0.00			0.16	0.10	0.69	0.07		
259 CHICK-84	51-66	3.67		9.93			0.63	0.02	0.12	0.01		
260 CHICK-84	52-42	2.39		6.29			17.96	0.03	0.20	0.02		

THERMAL PROPERTIES

9 Reference	13 Fe2O3 mol%	14 Ga2O3 mol%	15 GaO2 mol%	16 K2O mol%	17 Li2O mol%	18 MgO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
209 CHICK-84	8.90			0.00				0.00	0.00	18.36	0.00	0.00
210 CHICK-84	2.55			0.02				0.22	0.06	19.15	0.02	0.20
211 CHICK-84	10.85			0.07				0.93	0.23	16.60	0.09	0.82
212 CHICK-84	3.26			0.02				0.27	0.07	21.16	0.03	0.24
213 CHICK-84	2.65			0.02				0.29	0.07	31.61	0.03	0.26
214 CHICK-84	2.89			0.00				0.00	0.00	32.06	0.00	0.00
215 CHICK-84	3.53			0.02				0.30	0.08	21.50	0.03	0.27
216 CHICK-84	4.94			0.00				0.00	0.00	17.95	0.00	0.00
217 CHICK-84	7.56			0.00				0.00	0.00	13.59	0.00	0.00
218 CHICK-84	7.17			0.00				0.00	0.00	32.61	0.00	0.00
219 CHICK-84	0.00			0.06				0.79	0.20	34.89	0.08	0.70
220 CHICK-84	4.52			0.00				0.00	0.00	16.67	0.00	0.00
221 CHICK-84	6.13			0.03				0.41	0.10	18.90	0.04	0.36
222 CHICK-84	4.09			0.00				0.00	0.00	7.82	0.00	0.00
223 CHICK-84	9.34			0.00				0.00	0.00	11.29	0.00	0.00
224 CHICK-84	9.29			0.00				0.00	0.00	20.52	0.00	0.00
225 CHICK-84	9.13			0.00				0.00	0.00	34.20	0.00	0.00
226 CHICK-84	0.00			0.07				0.84	0.21	35.32	0.08	0.74
227 CHICK-84	0.00			0.07				0.83	0.21	9.13	0.08	0.73
228 CHICK-84	9.97			0.03				0.43	0.11	36.41	0.04	0.38
229 CHICK-84	2.17			0.02				0.21	0.05	17.44	0.02	0.18
230 CHICK-84	0.00			0.00				0.00	0.00	29.96	0.00	0.00
231 CHICK-84	6.10			0.03				0.42	0.11	15.71	0.04	0.37
232 CHICK-84	4.05			0.03				0.37	0.09	23.17	0.04	0.33
233 CHICK-84	0.00			0.00				0.00	0.00	16.32	0.00	0.00
234 CHICK-84	2.77			0.00				0.00	0.00	12.43	0.00	0.00
235 CHICK-84	0.00			0.00				0.00	0.00	30.36	0.00	0.00
236 CHICK-84	0.00			0.03				0.32	0.08	22.30	0.03	0.29
237 CHICK-84	4.19			0.03				0.34	0.09	23.67	0.03	0.30
238 CHICK-84	0.00			0.07				0.81	0.20	14.81	0.08	0.72
239 CHICK-84	0.00			0.00				0.00	0.00	16.60	0.00	0.00
240 CHICK-84	0.00			0.07				0.83	0.21	13.86	0.08	0.73
241 CHICK-84	0.00			0.00				0.00	0.00	12.31	0.00	0.00
242 CHICK-84	0.00			0.06				0.81	0.20	14.68	0.08	0.71
243 CHICK-84	2.52			0.03				0.34	0.09	24.57	0.03	0.30
244 CHICK-84	9.23			0.00				0.00	0.00	34.95	0.00	0.00
245 CHICK-84	0.00			0.06				0.79	0.20	31.64	0.08	0.70
246 CHICK-84	1.73			0.01				0.17	0.04	30.73	0.02	0.15
247 CHICK-84	1.81			0.02				0.20	0.05	7.59	0.02	0.18
248 CHICK-84	4.05			0.00				0.00	0.00	22.27	0.00	0.00
249 CHICK-84	2.53			0.00				0.00	0.00	17.63	0.00	0.00
250 CHICK-84	3.46			0.02				0.28	0.07	22.00	0.03	0.25
251 CHICK-84	0.00			0.06				0.80	0.20	14.00	0.08	0.71
252 CHICK-84	5.56			0.07				0.86	0.21	37.48	0.09	0.76
253 CHICK-84	0.00			0.07				0.82	0.21	35.31	0.08	0.73
254 CHICK-84	10.11			0.05				0.56	0.14	15.87	0.06	0.50
255 CHICK-84	0.00			0.06				0.73	0.18	14.99	0.07	0.64
256 CHICK-84	9.05			0.07				0.86	0.21	14.63	0.09	0.76
257 CHICK-84	0.00			0.00				0.00	0.00	12.69	0.00	0.00
258 CHICK-84	1.00			0.06				0.74	0.19	20.48	0.08	0.66
259 CHICK-84	1.77			0.01				0.13	0.03	15.57	0.01	0.11
260 CHICK-84	2.70			0.02				0.21	0.05	19.51	0.02	0.19

THERMAL PROPERTIES

0 Reference	25 P2O5 mol%	26 PbO mol%	27 PdO mol%	28 Rb2O mol%	29 Rh2O3 mol%	30 RuO2 mol%	31 Sb2O3 mol%	32 SiO2 mol%	33 SrO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
209 CHICK-84	0.00							71.55	0.00		0.00	
210 CHICK-84	0.81							47.92	0.06		0.57	
211 CHICK-84	3.36							60.78	0.25		2.36	
212 CHICK-84	0.99							51.49	0.08		0.70	
213 CHICK-84	1.05							47.89	0.08		0.73	
214 CHICK-84	0.00							39.17	0.00		0.00	
215 CHICK-84	1.10							52.43	0.08		0.77	
216 CHICK-84	0.00							61.13	0.00		0.00	
217 CHICK-84	0.00							73.24	0.00		0.00	
218 CHICK-84	0.00							41.45	0.00		0.00	
219 CHICK-84	2.86							43.50	0.22		2.01	
220 CHICK-84	0.00							67.02	0.00		0.00	
221 CHICK-84	1.40							57.51	0.11		1.04	
222 CHICK-84	0.00							73.22	0.00		0.00	
223 CHICK-84	0.00							47.58	0.00		0.00	
224 CHICK-84	0.00							43.39	0.00		0.00	
225 CHICK-84	0.00							44.32	0.00		0.00	
226 CHICK-84	3.03							45.64	0.23		2.12	
227 CHICK-84	2.90							44.24	0.23		2.10	
228 CHICK-84	1.57							47.53	0.12		1.10	
229 CHICK-84	0.75							66.33	0.06		0.53	
230 CHICK-84	0.00							38.00	0.00		0.00	
231 CHICK-84	1.53							64.58	0.12		1.07	
232 CHICK-84	1.35							55.03	0.10		0.94	
233 CHICK-84	0.00							64.50	0.00		0.00	
234 CHICK-84	0.00							66.15	0.00		0.00	
235 CHICK-84	0.00							64.24	0.00		0.00	
236 CHICK-84	1.17							52.15	0.09		0.82	
237 CHICK-84	1.24							55.19	0.09		0.87	
238 CHICK-84	2.95							50.06	0.22		2.07	
239 CHICK-84	0.00							61.97	0.00		0.00	
240 CHICK-84	2.99							45.55	0.23		2.10	
241 CHICK-84	0.00							64.57	0.00		0.00	
242 CHICK-84	2.92							48.52	0.22		2.05	
243 CHICK-84	1.24							45.00	0.09		0.87	
244 CHICK-84	0.00							49.08	0.00		0.00	
245 CHICK-84	2.86							40.36	0.22		2.00	
246 CHICK-84	0.63							65.02	0.09		0.44	
247 CHICK-84	0.72							63.79	0.05		0.51	
248 CHICK-84	0.00							52.09	0.00		0.00	
249 CHICK-84	0.00							60.73	0.00		0.00	
250 CHICK-84	1.02							52.57	0.08		0.71	
251 CHICK-84	2.90							72.24	0.22		2.03	
252 CHICK-84	3.10							46.64	0.23		2.17	
253 CHICK-84	2.98							49.60	0.23		2.09	
254 CHICK-84	2.04							49.11	0.15		1.43	
255 CHICK-84	2.63							70.51	0.20		1.84	
256 CHICK-84	3.10							59.66	0.23		2.18	
257 CHICK-84	0.00							52.90	0.00		0.00	
258 CHICK-84	2.70							70.43	0.20		1.84	
259 CHICK-84	0.47							66.92	0.04		0.33	
260 CHICK-84	0.78							48.80	0.06		0.55	

THERMAL PROPERTIES

0 Reference	37 U3O8 mol%	38 UH2 mol%	39 WO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZnO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
209 CHICK-84		0.00				0.00	100.00			
210 CHICK-84		0.18				0.07	100.00			
211 CHICK-84		0.75				0.28	100.00			
212 CHICK-84		0.22				0.08	100.00			
213 CHICK-84		0.23				0.09	100.00			
214 CHICK-84		0.00				0.00	100.00			
215 CHICK-84		0.74				0.09	100.00			
216 CHICK-84		0.00				0.00	100.00			
217 CHICK-84		0.00				0.00	100.00			
218 CHICK-84		0.00				0.00	100.00			
219 CHICK-84		0.64				0.24	100.00			
220 CHICK-84		0.00				0.00	100.00			
221 CHICK-84		0.33				0.13	100.00			
222 CHICK-84		0.00				0.00	100.00			
223 CHICK-84		0.00				0.00	100.00			
224 CHICK-84		0.00				0.00	100.00			
225 CHICK-84		0.00				0.00	100.00			
226 CHICK-84		0.67				0.26	100.00			
227 CHICK-84		0.66				0.25	100.00			
228 CHICK-84		0.35				0.13	100.00			
229 CHICK-84		0.17				0.06	100.00			
230 CHICK-84		0.00				0.00	100.00			
231 CHICK-84		0.34				0.13	100.00			
232 CHICK-84		0.30				0.11	100.00			
233 CHICK-84		0.00				0.00	100.00			
234 CHICK-84		0.00				0.00	100.00			
235 CHICK-84		0.00				0.00	100.00			
236 CHICK-84		0.26				0.10	100.00			
237 CHICK-84		0.27				0.10	100.00			
238 CHICK-84		0.66				0.25	100.00			
239 CHICK-84		0.00				0.00	100.00			
240 CHICK-84		0.66				0.25	100.00			
241 CHICK-84		0.00				0.00	100.00			
242 CHICK-84		0.65				0.25	100.00			
243 CHICK-84		0.28				0.11	100.00			
244 CHICK-84		0.00				0.00	100.00			
245 CHICK-84		0.64				0.24	100.00			
246 CHICK-84		0.14				0.05	100.00			
247 CHICK-84		0.16				0.06	100.00			
248 CHICK-84		0.00				0.00	100.00			
249 CHICK-84		0.00				0.00	100.00			
250 CHICK-84		0.23				0.09	100.00			
251 CHICK-84		0.64				0.25	100.00			
252 CHICK-84		0.69				0.26	100.00			
253 CHICK-84		0.66				0.25	100.00			
254 CHICK-84		0.45				0.17	100.00			
255 CHICK-84		0.58				0.22	100.00			
256 CHICK-84		0.49				0.26	100.00			
257 CHICK-84		0.00				0.00	100.00			
258 CHICK-84		0.60				0.23	100.00			
259 CHICK-84		0.10				0.04	100.00			
260 CHICK-84		0.17				0.07	100.00			

THERMAL PROPERTIES

0 Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
209 CHICK-84	2.35e-01						
210 CHICK-84	2.90e-01						
211 CHICK-84	1.93e-01						
212 CHICK-84	3.00e-01						
213 CHICK-84	8.90e-01						
214 CHICK-84	6.40e-01						
215 CHICK-84	3.00e-01						
216 CHICK-84	2.15e-01						
217 CHICK-84	1.50e-01						
218 CHICK-84	1.05e+00						
219 CHICK-84	8.00e-01						
220 CHICK-84	1.95e-01						
221 CHICK-84	2.85e-01						
222 CHICK-84	6.10e-02						
223 CHICK-84	1.20e-01						
224 CHICK-84	3.70e-01						
225 CHICK-84	9.20e-01						
226 CHICK-84	8.30e-01						
227 CHICK-84	5.90e-02						
228 CHICK-84	9.10e-01						
229 CHICK-84	2.20e-01						
230 CHICK-84	8.00e-01						
231 CHICK-84	1.83e-01						
232 CHICK-84	4.30e-01						
233 CHICK-84	1.77e-01						
234 CHICK-84	1.18e-01						
235 CHICK-84	5.70e-01						
236 CHICK-84	3.80e-01						
237 CHICK-84	4.40e-01						
238 CHICK-84	1.14e-01						
239 CHICK-84	1.80e-01						
240 CHICK-84	1.60e-01						
241 CHICK-84	6.80e-02						
242 CHICK-84	1.54e-01						
243 CHICK-84	4.90e-01						
244 CHICK-84	9.40e-01						
245 CHICK-84	8.00e-01						
246 CHICK-84	7.70e-01						
247 CHICK-84	3.00e-02						
248 CHICK-84	3.60e-01						
249 CHICK-84	2.10e-01						
250 CHICK-84	3.50e-01						
251 CHICK-84	1.50e-01						
252 CHICK-84	1.20e+00						
253 CHICK-84	7.70e-01						
254 CHICK-84	1.68e-01						
255 CHICK-84	1.13e-01						
256 CHICK-84	2.80e-01						
257 CHICK-84	1.07e-01						
258 CHICK-84	2.90e-01						
259 CHICK-84	2.13e-01						
260 CHICK-84	3.00e-01						

THERMAL PROPERTIES

0 Reference	54 EC, T100P ohm.cm-1	55 Tg(Trans. Temp)°C	56 Tg(Soft. Temp)°C	57 T30P °C	58 T100P °C	59 T(10)4P °C	60 T(10)5P °C	61 T(10)6P °C	62 T(10)7P °C
209 CHICK-84	0.10e-01			1501	2690.0				
210 CHICK-84	1.24e-01	524	567	1062	1954.0				
211 CHICK-84	3.20e-01	519	579	1399	2654.0				
212 CHICK-84	2.70e-01	522	555	1254	2244.0				
213 CHICK-84	3.80e-01	445	487	1026	1838.0				
214 CHICK-84	4.40e-01			1147	2062.0				
215 CHICK-84	2.10e-01	508	565	1172	2104.0				
216 CHICK-84	2.60e-01	522	577	1391	2430.0				
217 CHICK-84	3.80e-01	540	607	1747	3172.0				
218 CHICK-84	4.40e-01	477	525	1064	2068.0				
219 CHICK-84		418	485	998	935.0				
220 CHICK-84	2.15e-01	539	585	1335	2360.0				
221 CHICK-84	2.20e-01	522	570	1224	2156.0				
222 CHICK-84	1.50e-01	510	585	1699	2994.0				
223 CHICK-84	1.70e-01	497	559	1350	2570.0				
224 CHICK-84	9.40e-02	466	512	960	1708.0				
225 CHICK-84	2.30e-01	416	446	870	1516.0				
226 CHICK-84	2.40e-01	519	576	1337	2462.0				
227 CHICK-84	7.90e-02	572	628	1343	2434.0				
228 CHICK-84	6.40e-01	434	471	1073	1902.0				
229 CHICK-84	3.10e-01	539	594	1436	2530.0				
230 CHICK-84	2.40e-01	451	489	897	1620.0				
231 CHICK-84	2.40e-01	537	590	1419	2476.0				
232 CHICK-84	3.50e-01	527	575	1240	2178.0				
233 CHICK-84	2.83e-01	585	627	1582	2760.0				
234 CHICK-84	1.40e-01	546	586	1364	2396.0				
235 CHICK-84	6.60e-01	487	536	1431	2480.0				
236 CHICK-84	2.37e-01	532	579	1168	2052.0				
237 CHICK-84	4.10e-01	532	580	1297	2248.0				
238 CHICK-84	1.55e-01	616	685	1383	2440.0				
239 CHICK-84	2.65e-01	588	632	1454	2588.0				
240 CHICK-84	1.80e-01	517	571	1457	2466.0				
241 CHICK-84	1.10e-01	550	606	1503	2654.0				
242 CHICK-84	1.73e-01	537	592	1343	2378.0				
243 CHICK-84	1.77e-01	499	542	1039	1882.0				
244 CHICK-84	8.60e-01	451	507	1249	2224.0				
245 CHICK-84					1032.0				
246 CHICK-84	8.80e-01	470	514	1374	2382.0				
247 CHICK-84	1.40e-01	684	727	1632	2962.0				
248 CHICK-84	2.17e-01	508	549	1147	2042.0				
249 CHICK-84	3.60e-01	547	606	1555	2732.0				
250 CHICK-84	2.45e-01	523	567	1183	2096.0				
251 CHICK-84	4.00e-01	621	699	1806	3250.0				
252 CHICK-84		468	530		1083.0				
253 CHICK-84	6.40e-01	507	567	1330	2382.0				
254 CHICK-84	2.10e-01	577	645	1317	2404.0				
255 CHICK-84	2.65e-01	607	666	1600	2850.0				
256 CHICK-84	3.80e-01	569	642	1513	2648.0				
257 CHICK-84	5.90e-02	580	622	1152	2064.0				
258 CHICK-84	5.30e-01	515	581	1522	2728.0				
259 CHICK-84	3.40e-01	557	608	1542	2670.0				
260 CHICK-84	1.53e-01	527	568	1124	2012.0				

THERMAL PROPERTIES

0 Reference	63 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
209 CHICK-84							
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THERMAL PROPERTIES

0 Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
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THERMAL PROPERTIES

0 Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
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THERMAL PROPERTIES

0 Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th.Exp. Lin.Coeff.
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209 CHICK-84				
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THERMAL PROPERTIES

0 Reference	1 Glass ID or Data Source	2 Al ₂ O ₃ mol%	3 AlN mol%	4 B ₂ O ₃ mol%	5 BaO mol%	6 BeO mol%	7 CaO mol%	8 CeO ₂ mol%	9 Cr ₂ O ₃ mol%	10 Cu ₂ O mol%	11 CuO mol%	12 F mol%
261 CHICK-84	53-52	0.41		0.00			17.20	0.03	0.20		0.02	
262 CHICK-84	54-72	7.67		18.35			17.43	0.00	0.00		0.00	
263 CHICK-84	55-27	5.15		18.10			8.10	0.00	0.00		0.00	
264 CHICK-84	56-6A	0.57		0.00			13.64	0.11	0.75		0.08	
265 CHICK-84	57-07	0.75		0.00			5.21	0.00	0.00		0.00	
266 CHICK-84	58-39	3.63		9.42			8.92	0.04	0.31		0.03	
267 CHICK-84	59-06	5.24		17.94			0.18	0.00	0.00		0.00	
268 CHICK-84	60-20	6.18		25.15			0.32	0.00	0.00		0.00	
269 CHICK-84	61-60	0.72		9.30			3.19	0.06	0.40		0.04	
270 CHICK-84	62-54	2.93		19.61			18.77	0.06	0.41		0.04	
271 CHICK-84	63-38	3.01		7.99			7.76	0.04	0.28		0.03	
272 CHICK-84	64-28	0.59		20.37			11.62	0.00	0.00		0.00	
273 CHICK-84	65-49	0.71		0.00			20.91	0.09	0.60		0.07	
274 CHICK-84	66-33	0.15		16.99			16.88	0.00	0.00		0.00	
275 CHICK-84	67-75	9.26		0.00			0.25	0.00	0.00		0.00	
276 CHICK-84	68-50	5.54		0.00			17.94	0.03	0.20		0.02	
277 CHICK-84	69-16	8.26		0.00			19.92	0.00	0.00		0.00	
278 CHICK-84	70-55	3.00		19.24			0.30	0.00	0.00		0.00	
279 CHICK-84	71-33	2.98		9.27			8.42	0.09	0.63		0.07	
280 CHICK-84	72-02	5.15		0.00			0.37	0.00	0.00		0.00	
281 CHICK-84	73-01	5.03		0.00			16.87	0.00	0.00		0.00	
282 CHICK-84	74-12	0.22		0.00			15.99	0.00	0.00		0.00	
283 CHICK-84	75-26	6.08		8.66			19.45	0.10	0.73		0.08	
284 CHICK-84	76-29	0.32		19.85			14.23	0.11	0.75		0.08	
285 CHICK-84	77-25	5.58		19.10			18.58	0.00	0.00		0.00	
286 CHICK-84	78-48	2.56		6.17			5.75	0.11	0.74		0.08	
287 CHICK-84	79-43	0.52		8.61			8.43	0.04	0.30		0.03	
288 CHICK-84	80-46	2.61		5.89			5.68	0.03	0.22		0.02	
289 CHICK-84	81-34	3.01		8.00			7.89	0.04	0.28		0.03	
290 CHICK-84	92-24	0.24		19.38			0.00	0.09	0.60		0.07	
291 CHICK-84	93-08	0.27		17.41			0.28	0.00	0.00		0.00	
292 CHICK-84	84-51	0.71		22.03			0.28	0.08	0.58		0.06	
293 CHICK-84	95-16	6.15		0.00			20.05	0.00	0.00		0.00	
294 CHICK-84	96-83	7.65		0.00			0.11	0.00	0.00		0.00	
295 CHICK-84	87-86	5.17		0.00			16.45	0.03	0.19		0.02	
296 CHICK-84	88-91	0.31		5.44			17.30	0.03	0.19		0.02	
297 CHICK-84	89-77	5.69		17.35			0.21	0.00	0.00		0.00	
298 CHICK-84	90-85	0.51		0.00			16.21	0.09	0.62		0.07	
299 CHICK-84	91-89	9.20		10.39			0.26	0.06	0.40		0.04	
300 CHICK-84	92-84	2.57		6.96			6.57	0.08	0.53		0.06	
301 CHICK-84	93-81	0.21		16.96			10.07	0.06	0.44		0.05	
302 CHICK-84	94-32	2.42		6.08			0.32	0.10	0.72		0.08	
303 CHICK-84	95-30	9.26		0.00			13.11	0.06	0.39		0.04	
304 CHICK-84	96-76	0.19		0.00			13.90	0.00	0.00		0.00	
305 CHICK-84	97-82	0.18		0.00			14.15	0.08	0.56		0.06	
306 CHICK-84	98-73	0.44		0.00			0.58	0.10	0.67		0.07	
307 CHICK-84	99-73	0.64		0.00			15.51	0.05	0.37		0.04	
308 CHICK-84	100-93	3.22		0.00			9.91	0.05	0.38		0.04	
309 CHICK-84	101-88	4.73		16.26			15.48	0.00	0.00		0.00	
310 CHICK-84	102-87	8.52		18.09			0.25	0.10	0.67		0.07	
311 CHICK-84	103-83	0.20		12.83			11.86	0.00	0.00		0.00	
312 GEISS-85	#1	22.25		0.00								

THERMAL PROPERTIES

0 Reference	13 Fe2O3 mol%	14 Ga2O3 mol%	15 GeO2 mol%	16 K2O mol%	17 Li2O mol%	18 HgO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
261 CHICK-84	2.26			0.02				0.22	0.06	12.60	0.02	0.20
262 CHICK-84	0.00			0.00				0.00	0.00	19.14	0.00	0.00
263 CHICK-84	0.00			0.00				0.00	0.00	31.49	0.00	0.00
264 CHICK-84	0.00			0.07				0.81	0.20	8.27	0.08	0.72
265 CHICK-84	8.66			0.00				0.00	0.00	13.67	0.00	0.00
266 CHICK-84	0.06			0.03				0.33	0.08	14.08	0.03	0.30
267 CHICK-84	0.00			0.00				0.00	0.00	12.36	0.00	0.00
268 CHICK-84	0.00			0.00				0.00	0.00	14.06	0.00	0.00
269 CHICK-84	5.83			0.04				0.44	0.11	19.11	0.04	0.39
270 CHICK-84	0.00			0.04				0.44	0.11	13.54	0.04	0.39
271 CHICK-84	3.84			0.02				0.30	0.08	22.21	0.03	0.27
272 CHICK-84	8.97			0.00				0.00	0.00	14.33	0.00	0.00
273 CHICK-84	8.14			0.05				0.65	0.16	15.32	0.07	0.57
274 CHICK-84	0.00			0.00				0.00	0.00	30.54	0.00	0.00
275 CHICK-84	9.08			0.00				0.00	0.00	36.23	0.00	0.00
276 CHICK-84	2.11			0.02				0.22	0.05	32.57	0.02	0.19
277 CHICK-84	0.09			0.00				0.00	0.00	14.63	0.00	0.00
278 CHICK-84	3.96			0.00				0.00	0.00	33.90	0.00	0.00
279 CHICK-84	0.00			0.05				0.68	0.17	31.39	0.07	0.61
280 CHICK-84	0.00			0.00				0.00	0.00	31.26	0.00	0.00
281 CHICK-84	0.00			0.00				0.00	0.00	17.36	0.00	0.00
282 CHICK-84	0.00			0.00				0.00	0.00	29.42	0.00	0.00
283 CHICK-84	0.00			0.06				0.79	0.20	14.40	0.06	0.70
284 CHICK-84	0.00			0.07				0.81	0.20	14.14	0.08	0.72
285 CHICK-84	3.56			0.00				0.00	0.00	13.60	0.00	0.00
286 CHICK-84	2.64			0.06				0.81	0.20	21.53	0.08	0.71
287 CHICK-84	3.66			0.03				0.33	0.08	23.08	0.03	0.29
288 CHICK-84	0.27			0.02				0.24	0.06	20.83	0.02	0.21
289 CHICK-84	3.44			0.02				0.31	0.08	21.99	0.03	0.27
290 CHICK-84	0.00			0.05				0.65	0.16	33.44	0.07	0.58
291 CHICK-84	0.00			0.00				0.00	0.00	21.12	0.00	0.00
292 CHICK-84	7.25			0.05				0.83	0.16	15.47	0.06	0.56
293 CHICK-84	8.89			0.00				0.00	0.00	14.42	0.00	0.00
294 CHICK-84	0.00			0.00				0.00	0.00	27.46	0.00	0.00
295 CHICK-84	1.93			0.02				0.21	0.05	30.23	0.02	0.19
296 CHICK-84	1.03			0.02				0.21	0.05	18.77	0.02	0.18
297 CHICK-84	0.16			0.00				0.00	0.00	14.26	0.00	0.00
298 CHICK-84	5.86			0.05				0.68	0.17	14.55	0.07	0.60
299 CHICK-84	0.78			0.03				0.43	0.11	18.38	0.04	0.38
300 CHICK-84	2.99			0.05				0.57	0.14	21.72	0.06	0.51
301 CHICK-84	0.00			0.04				0.48	0.12	14.03	0.05	0.42
302 CHICK-84	0.00			0.06				0.78	0.19	21.67	0.08	0.69
303 CHICK-84	0.74			0.03				0.43	0.11	18.14	0.04	0.38
304 CHICK-84	0.00			0.00				0.00	0.00	25.73	0.00	0.00
305 CHICK-84	0.00			0.05				0.60	0.15	24.72	0.06	0.54
306 CHICK-84	0.48			0.06				0.73	0.18	31.83	0.07	0.64
307 CHICK-84	6.51			0.03				0.40	0.10	14.74	0.04	0.36
308 CHICK-84	0.00			0.03				0.42	0.10	11.78	0.04	0.37
309 CHICK-84	8.18			0.00				0.00	0.00	12.80	0.00	0.00
310 CHICK-84	0.00			0.06				0.73	0.18	12.00	0.07	0.65
311 CHICK-84	0.00			0.06				0.00	0.00	21.87	0.00	0.00
312 GEISS-85												

THERMAL PROPERTIES

# Reference	25 P2O5 mol%	26 PbO mol%	27 P4O10 mol%	28 Pb2O mol%	29 H2O3 mol%	30 H2O2 mol%	31 SO3 mol%	32 SiO2 mol%	33 SrO mol%	34 FeO2 mol%	35 FeO2 mol%	36 TiO2 mol%
261 CHICK-B4	0.81							65.09	0.06		0.57	
262 CHICK-B4	0.00							37.42	0.00		0.00	
263 CHICK-B4	0.00							37.17	0.00		0.00	
264 CHICK-B4	2.94							68.58	0.22		2.06	
265 CHICK-B4	0.00							71.70	0.00		0.00	
266 CHICK-B4	1.21							56.20	0.09		0.85	
267 CHICK-B4	0.00							64.28	0.00		0.00	
268 CHICK-B4	0.00							45.25	0.00		0.00	
269 CHICK-B4	1.58							57.03	0.12		1.11	
270 CHICK-B4	1.61							48.25	0.12		1.13	
271 CHICK-B4	1.10							52.24	0.08		0.77	
272 CHICK-B4	0.00							44.11	0.00		0.00	
273 CHICK-B4	2.34							47.80	0.14		1.64	
274 CHICK-B4	0.00							35.44	0.00		0.00	
275 CHICK-B4	0.00							45.18	0.00		0.00	
276 CHICK-B4	0.78							39.45	0.06		0.55	
277 CHICK-B4	0.00							50.11	0.00		0.00	
278 CHICK-B4	0.00							39.60	0.00		0.00	
279 CHICK-B4	2.48							40.41	0.19		1.74	
280 CHICK-B4	0.00							63.22	0.00		0.00	
281 CHICK-B4	0.00							60.73	0.00		0.00	
282 CHICK-B4	0.00							54.37	0.00		0.00	
283 CHICK-B4	2.86							42.71	0.22		2.06	
284 CHICK-B4	2.94							42.52	0.22		2.06	
285 CHICK-B4	0.00							39.58	0.00		0.00	
286 CHICK-B4	2.92							52.46	0.22		2.05	
287 CHICK-B4	1.19							52.10	0.09		0.83	
288 CHICK-B4	0.87							53.07	0.07		0.61	
289 CHICK-B4	1.12							52.27	0.08		0.74	
290 CHICK-B4	2.36							39.77	0.18		1.66	
291 CHICK-B4	0.00							60.93	0.00		0.00	
292 CHICK-B4	2.28							47.32	0.17		1.60	
293 CHICK-B4	0.00							50.50	0.00		0.00	
294 CHICK-B4	0.00							64.78	0.00		0.00	
295 CHICK-B4	0.76							43.92	0.06		0.53	
296 CHICK-B4	0.75							54.87	0.06		0.53	
297 CHICK-B4	0.00							54.32	0.00		0.00	
298 CHICK-B4	2.44							55.43	0.18		1.72	
299 CHICK-B4	1.56							52.26	0.12		1.09	
300 CHICK-B4	2.07							52.90	0.16		1.45	
301 CHICK-B4	1.71							53.43	0.13		1.22	
302 CHICK-B4	2.81							61.00	0.21		1.97	
303 CHICK-B4	1.54							50.04	0.12		1.08	
304 CHICK-B4	0.00							60.18	0.00		0.00	
305 CHICK-B4	2.19							54.30	0.17		1.54	
306 CHICK-B4	2.63							54.66	0.20		1.85	
307 CHICK-B4	1.46							58.15	0.11		1.03	
308 CHICK-B4	1.51							65.65	0.11		1.06	
309 CHICK-B4	0.00							47.63	0.00		0.00	
310 CHICK-B4	2.65							53.08	0.20		1.86	
311 CHICK-B4	0.00							53.25	0.00		0.00	
312 BELBY-B4	0.00							55.50				

THERMAL PROPERTIES

0 Reference	37 U3O8 mol%	38 UO2 mol%	39 UO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZrO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
261 CHICK-84		0.18				0.07	100.00			
262 CHICK-84		0.00				0.00	100.00			
263 CHICK-84		0.00				0.00	100.00			
264 CHICK-84		0.65				0.25	100.00			
265 CHICK-84		0.00				0.00	100.00			
266 CHICK-84		0.27				0.10	100.00			
267 CHICK-84		0.00				0.00	100.00			
268 CHICK-84		0.00				0.00	100.00			
269 CHICK-84		0.35				0.13	100.00			
270 CHICK-84		0.36				0.14	100.00			
271 CHICK-84		0.24				0.09	100.00			
272 CHICK-84		0.00				0.00	100.00			
273 CHICK-84		0.52				0.20	100.00			
274 CHICK-84		0.00				0.00	100.00			
275 CHICK-84		0.00				0.00	100.00			
276 CHICK-84		0.17				0.07	100.00			
277 CHICK-84		0.00				0.00	100.00			
278 CHICK-84		0.00				0.00	100.00			
279 CHICK-84		0.55				0.21	100.00			
280 CHICK-84		0.00				0.00	100.00			
281 CHICK-84		0.00				0.00	100.00			
282 CHICK-84		0.00				0.00	100.00			
283 CHICK-84		0.63				0.24	100.00			
284 CHICK-84		0.65				0.25	100.00			
285 CHICK-84		0.00				0.00	100.00			
286 CHICK-84		0.65				0.25	100.00			
287 CHICK-84		0.26				0.10	100.00			
288 CHICK-84		0.19				0.07	100.00			
289 CHICK-84		0.25				0.09	100.00			
290 CHICK-84		0.52				0.20	100.00			
291 CHICK-84		0.00				0.00	100.00			
292 CHICK-84		0.51				0.19	100.00			
293 CHICK-84		0.00				0.00	100.00			
294 CHICK-84		0.00				0.00	100.00			
295 CHICK-84		0.17				0.06	100.00			
296 CHICK-84		0.17				0.06	100.00			
297 CHICK-84		0.00				0.00	100.00			
298 CHICK-84		0.54				0.21	100.00			
299 CHICK-84		0.35				0.13	100.00			
300 CHICK-84		0.46				0.18	100.00			
301 CHICK-84		0.39				0.15	100.00			
302 CHICK-84		0.63				0.24	100.00			
303 CHICK-84		0.30				0.13	100.00			
304 CHICK-84		0.00				0.00	100.00			
305 CHICK-84		0.49				0.19	100.00			
306 CHICK-84		0.58				0.22	100.00			
307 CHICK-84		0.33				0.12	100.00			
308 CHICK-84		0.34				0.13	100.00			
309 CHICK-84		0.00				0.00	100.00			
310 CHICK-84		0.59				0.22	100.00			
311 CHICK-84		0.00				0.00	100.00			
312 GEISS-85							100.01			

THERMAL PROPERTIES

0 Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
261 CHICK-84	1.02e-01						
262 CHICK-84	2.20e-01						
263 CHICK-84	1.10e+00						
264 CHICK-84	3.60e-02						
265 CHICK-84	1.50e-01						
266 CHICK-84	2.55e-01						
267 CHICK-84	8.50e-02						
268 CHICK-84	2.40e-01						
269 CHICK-84	3.30e-01						
270 CHICK-84	1.36e-01						
271 CHICK-84	3.80e-01						
272 CHICK-84	1.67e-01						
273 CHICK-84	9.30e-02						
274 CHICK-84	7.90e-01						
275 CHICK-84	8.00e-01						
276 CHICK-84	7.60e-01						
277 CHICK-84	9.10e-02						
278 CHICK-84	8.90e-01						
279 CHICK-84	8.10e-01						
280 CHICK-84	7.10e-01						
281 CHICK-84	1.80e-01						
282 CHICK-84	6.30e-01						
283 CHICK-84	1.56e-01						
284 CHICK-84	1.70e-01						
285 CHICK-84	1.45e-01						
286 CHICK-84	3.20e-01						
287 CHICK-84	4.20e-01						
288 CHICK-84	3.20e-01						
289 CHICK-84	3.70e-01						
290 CHICK-84	9.70e-01						
291 CHICK-84	3.00e-01						
292 CHICK-84	2.15e-01						
293 CHICK-84	1.18e-01						
294 CHICK-84	3.90e-01						
295 CHICK-84	5.90e-01						
296 CHICK-84	2.90e-01						
297 CHICK-84	1.90e-01						
298 CHICK-84	1.55e-01						
299 CHICK-84	2.60e-01						
300 CHICK-84	3.90e-01						
301 CHICK-84	1.28e-01						
302 CHICK-84	3.00e-01						
303 CHICK-84	2.00e-01						
304 CHICK-84	5.40e-01						
305 CHICK-84	4.90e-01						
306 CHICK-84	8.20e-01						
307 CHICK-84	3.70e-01						
308 CHICK-84	8.30e-02						
309 CHICK-84	1.33e-01						
310 CHICK-84	1.05e-01						
311 CHICK-84	4.60e-01						
312 GELSS-85							

1 Reference	54 EC, 1100P ohm.cm-1	55 Tq(Ttrans. Temp) oC	56 Tq(Soft. Temp) oC	57 T130P oC	58 T100P oC	59 T(10)4P oC	60 T(10)5P oC	61 T(10)6P oC	62 T(10)7P oC
261 CHICK-B4	1.67e-01	567	634	1416	2536.0				
262 CHICK-B4	8.60e-02	457	507	1057	1924.0				
263 CHICK-B4	3.40e-01	527	563	910	1614.0				
264 CHICK-B4	9.30e-02	650	704	1582	2872.0				
265 CHICK-B4	2.20e-01	522	571	1445	2540.0				
266 CHICK-B4	2.85e-01	550	607	1312	2360.0				
267 CHICK-B4	1.57e-01	547	597	1589	2804.0				
268 CHICK-B4		499	597	1258	1140.0				
269 CHICK-B4	2.93e-01	542	588	1222	2220.0				
270 CHICK-B4		572	616		1106.0				
271 CHICK-B4	2.90e-01	518	565	1222	2156.0				
272 CHICK-B4	6.00e-02	526	575	1055	1902.0				
273 CHICK-B4		562	618		1166.0				
274 CHICK-B4		446	484		8.0				
275 CHICK-B4	9.10e-01			1335	2382.0				
276 CHICK-B4	3.60e-01			1114	2014.0				
277 CHICK-B4	1.10e-01	560	615	1317	2374.0				
278 CHICK-B4		477	490	886	808.0				
279 CHICK-B4		441	476		826.0				
280 CHICK-B4	7.40e-01	489	530	1332	2336.0				
281 CHICK-B4	2.90e-01	568	629	1460	2614.0				
282 CHICK-B4		493	531	1176	1135.0				
283 CHICK-B4		571	626	1195	1126.0				
284 CHICK-B4		567	614		1097.0				
285 CHICK-B4		545	589	1043	977.0				
286 CHICK-B4		544	604	1231	1116.0				
287 CHICK-B4	2.90e-01	512	557	1126	2002.0				
288 CHICK-B4	2.40e-01	516	557	1215	2134.0				
289 CHICK-B4	2.80e-01	517	558	1195	2086.0				
290 CHICK-B4	3.30e-01	470	509	886	1640.0				
291 CHICK-B4	2.15e-01	564	610	1176	2100.0				
292 CHICK-B4	1.47e-01	516	557	1162	2120.0				
293 CHICK-B4	1.28e-01	567	623	1307	2332.0				
294 CHICK-B4	5.20e-01	501	547	1542	2696.0				
295 CHICK-B4	4.70e-01	486	532	1200	2156.0				
296 CHICK-B4	2.10e-01	537	581	1204	2120.0				
297 CHICK-B4	2.50e-01	502	555	1422	2462.0				
298 CHICK-B4	1.57e-01	580	624	1287	2304.0				
299 CHICK-B4	4.30e-01	531	589	1469	2654.0				
300 CHICK-B4	3.40e-01	510	550	1282	2212.0				
301 CHICK-B4		569	616	1224	1110.0				
302 CHICK-B4	4.20e-01	546	577	1451	2554.0				
303 CHICK-B4	3.10e-01	477	562	1428	2550.0				
304 CHICK-B4	5.40e-01	492	529	1324	2304.0				
305 CHICK-B4	4.60e-01	516	556	1290	2262.0				
306 CHICK-B4	7.40e-01	474	519	1261	2220.0				
307 CHICK-B4	1.10e-01	425	483	1006	1748.0				
308 CHICK-B4	2.10e-01	537	577	1545	2766.0				
309 CHICK-B4	8.20e-02	549	592	1183	2120.0				
310 CHICK-B4	2.00e-01	524	573	1562	2776.0				
311 CHICK-B4	2.30e-01	528	567	1086	1930.0				
312 GEISS-B5									

THERMAL PROPERTIES

Reference	63 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
261 CHICK-84							
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310 CHICK-84							
311 CHICK-84							
312 GEL38-85							

THERMAL PROPERTIES

9 Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
261 CHICK-54						
262 CHICK-54						
263 CHICK-54						
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308 CHICK-54						
309 CHICK-54						
310 CHICK-54						
311 CHICK-54						
312 GFIS-55						

At 900 C, 7.76e+09

THERMAL PROPERTIES

1 Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
261 CHIC4-34						
262 CHIC4-34						
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308 CHIC4-34						
309 CHIC4-34						
310 CHIC4-34						
311 CHIC4-34						
312 GET99-35						

At 920 C, 2.88e409

THERMAL PROPERTIES

0 Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th.Exo. Lin.Coeff.
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261 CHICK-84				
262 CHICK-84				
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310 CHICK-84				
311 CHICK-84				
312 GE195-85				

THERMAL PROPERTIES

11 Reference	1 Glass ID or Data Source	2 Al ₂ O ₃ mol%	3 AlN mol%	4 B ₂ O ₃ mol%	5 BaO mol%	6 BeO mol%	7 CaO mol%	8 CeO ₂ mol%	9 Cr ₂ O ₃ mol%	10 Ca ₂ O mol%	11 CuO mol%	12 F mol%
313	GEISS-85	#2		0.95								
314	GEISS-85	#3		0.87								
315	GEISS-85	#4		1.10								
316	GEISS-85	#5		0.00								
317	KUBAYASHI-84	#1		9.40								
318	KUBAYASHI-84	#2		33.81								
319	KUBAYASHI-84	#3		35.08								
320	KUBAYASHI-84	#4		27.09								
321	KUBAYASHI-84	#5		59.64								
322	KONIJNENDIJK-76	Fig. 1,9		100.00								
323	KONIJNENDIJK-76	Fig. 1,9		95.00								
324	KONIJNENDIJK-76	Fig. 1,9		90.00								
325	KONIJNENDIJK-76	Fig. 1,9		80.00								
326	KONIJNENDIJK-76	Fig. 1,9		70.00								
327	KONIJNENDIJK-76	Fig. 1,9		85.00								
328	KONIJNENDIJK-76	Fig. 1,9		82.00								
329	KONIJNENDIJK-76	Fig. 1,9		80.00								
330	KONIJNENDIJK-76	Fig. 1,9		78.00								
331	KONIJNENDIJK-76	Fig. 1,9		75.00								
332	KONIJNENDIJK-76	Fig. 1,9		65.00								
333	KONIJNENDIJK-76	Fig. 1,9		55.00								
334	KONIJNENDIJK-76	Fig. 1,9		82.00								
335	KONIJNENDIJK-76	Fig. 1,9		75.00								
336	KONIJNENDIJK-76	Fig. 1,9		65.00								
337	KONIJNENDIJK-76	Fig. 1,9		55.00								
338	KONIJNENDIJK-76	Fig. 2		65.00								
339	KONIJNENDIJK-76	Fig. 2,10		64.00								
340	KONIJNENDIJK-76	Fig. 2,10		62.00								
341	KONIJNENDIJK-76	Fig. Fig. 2,10		60.00								
342	KONIJNENDIJK-76	Fig. 2,10		55.00								
343	KONIJNENDIJK-76	Fig. 2,10		45.00								
344	KONIJNENDIJK-76	Fig. 2,10		35.00								
345	KONIJNENDIJK-76	Fig. 2,10		25.00								
346	KONIJNENDIJK-76	Fig. 2		34.00								
347	KONIJNENDIJK-76	Fig. 2,10		30.00								
348	KONIJNENDIJK-76	Fig. 2,10		25.00								
349	KONIJNENDIJK-76	Fig. 2,10		15.00								
350	KONIJNENDIJK-76	Fig. 2,10		5.00								
351	KONIJNENDIJK-76	Fig. 2,10		34.00								
352	KONIJNENDIJK-76	Fig. 2,10		30.00								
353	KONIJNENDIJK-76	Fig. 2,10		25.00								
354	KONIJNENDIJK-76	Fig. 2,10		5.00								
355	KONIJNENDIJK-76	Fig. 3,11		95.00								
356	KONIJNENDIJK-76	Fig. 3,11		90.00								
357	KONIJNENDIJK-76	Fig. 3,11		80.00								
358	KONIJNENDIJK-76	Fig. 3,11		70.00								
359	KONIJNENDIJK-76	Fig. 3,11		75.00								
360	KONIJNENDIJK-76	Fig. 3,11		70.00								
361	KONIJNENDIJK-76	Fig. 3,11		65.00								
362	KONIJNENDIJK-76	Fig. 3,11		55.00								
363	KONIJNENDIJK-76	Fig. 4,12		65.00								
364	KONIJNENDIJK-76	Fig. 4,12		60.00								

THERMAL PROPERTIES

Reference	13 Fe2O3 mol%	14 Gd2O3 mol%	15 GdO2 mol%	16 K2O mol%	17 Li2O mol%	18 NaO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 HfO mol%
313 GEISS-85						21.79						
314 GEISS-85						30.01						
315 GEISS-85						32.61						
316 GEISS-85						25.49						
317 KOBAYASHI-84												
318 KOBAYASHI-84												
319 KOBAYASHI-84												
320 KOBAYASHI-84												
321 KOBAYASHI-84												
322 KONTJNEENDIJK-76												
323 KONTJNEENDIJK-76										5.00		
324 KONTJNEENDIJK-76										10.00		
325 KONTJNEENDIJK-76										20.00		
326 KONTJNEENDIJK-76										30.00		
327 KONTJNEENDIJK-76												
328 KONTJNEENDIJK-76										3.00		
329 KONTJNEENDIJK-76										5.00		
330 KONTJNEENDIJK-76										7.00		
331 KONTJNEENDIJK-76										10.00		
332 KONTJNEENDIJK-76										20.00		
333 KONTJNEENDIJK-76										30.00		
334 KONTJNEENDIJK-76				1.50						1.50		
335 KONTJNEENDIJK-76				5.00						5.00		
336 KONTJNEENDIJK-76				10.00						10.00		
337 KONTJNEENDIJK-76				15.00						15.00		
338 KONTJNEENDIJK-76										0.00		
339 KONTJNEENDIJK-76										1.00		
340 KONTJNEENDIJK-76										3.00		
341 KONTJNEENDIJK-76										5.00		
342 KONTJNEENDIJK-76										10.00		
343 KONTJNEENDIJK-76										20.00		
344 KONTJNEENDIJK-76										30.00		
345 KONTJNEENDIJK-76										40.00		
346 KONTJNEENDIJK-76										1.00		
347 KONTJNEENDIJK-76										5.00		
348 KONTJNEENDIJK-76										10.00		
349 KONTJNEENDIJK-76										20.00		
350 KONTJNEENDIJK-76										30.00		
351 KONTJNEENDIJK-76				0.50						0.50		
352 KONTJNEENDIJK-76				2.50						2.50		
353 KONTJNEENDIJK-76				5.00						5.00		
354 KONTJNEENDIJK-76				15.00						15.00		
355 KONTJNEENDIJK-76				5.00								
356 KONTJNEENDIJK-76				10.00								
357 KONTJNEENDIJK-76				20.00								
358 KONTJNEENDIJK-76				30.00								
359 KONTJNEENDIJK-76				10.00								
360 KONTJNEENDIJK-76				15.00								
361 KONTJNEENDIJK-76				20.00								
362 KONTJNEENDIJK-76				30.00								
363 KONTJNEENDIJK-76				0.00								
364 KONTJNEENDIJK-76				5.00								

THERMAL PROPERTIES

0 Reference	25 P2O5 mol%	26 PbO mol%	27 PdO mol%	28 Rb2O mol%	29 Rh2O3 mol%	30 RuO2 mol%	31 Sb2O3 mol%	32 SiO2 mol%	33 SrO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
313 GEISS-85	1.30							54.19				
314 GEISS-85	1.19							55.36				
315 GEISS-85	0.10							53.95				
316 GEISS-85	0.00							58.19				
317 KUBAYASHI-84		0.16						58.54				
318 KUBAYASHI-84	2.76							6.53				
319 KUBAYASHI-84	2.77							5.24				
320 KUBAYASHI-84	2.77	1.06						13.08				
321 KUBAYASHI-84		3.38						20.11				
322 KONTJNENDIJK-76												
323 KONTJNENDIJK-76												
324 KONTJNENDIJK-76												
325 KONTJNENDIJK-76												
326 KONTJNENDIJK-76												
327 KONTJNENDIJK-76								15.00				
328 KONTJNENDIJK-76								15.00				
329 KONTJNENDIJK-76								15.00				
330 KONTJNENDIJK-76								15.00				
331 KONTJNENDIJK-76								15.00				
332 KONTJNENDIJK-76								15.00				
333 KONTJNENDIJK-76								15.00				
334 KONTJNENDIJK-76								15.00				
335 KONTJNENDIJK-76								15.00				
336 KONTJNENDIJK-76								15.00				
337 KONTJNENDIJK-76								15.00				
338 KONTJNENDIJK-76								35.00				
339 KONTJNENDIJK-76								35.00				
340 KONTJNENDIJK-76								35.00				
341 KONTJNENDIJK-76								35.00				
342 KONTJNENDIJK-76								35.00				
343 KONTJNENDIJK-76								35.00				
344 KONTJNENDIJK-76								35.00				
345 KONTJNENDIJK-76								35.00				
346 KONTJNENDIJK-76								65.00				
347 KONTJNENDIJK-76								65.00				
348 KONTJNENDIJK-76								65.00				
349 KONTJNENDIJK-76								65.00				
350 KONTJNENDIJK-76								65.00				
351 KONTJNENDIJK-76								65.00				
352 KONTJNENDIJK-76								65.00				
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354 KONTJNENDIJK-76								65.00				
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358 KONTJNENDIJK-76												
359 KONTJNENDIJK-76								15.00				
360 KONTJNENDIJK-76								15.00				
361 KONTJNENDIJK-76								15.00				
362 KONTJNENDIJK-76								15.00				
363 KONTJNENDIJK-76								35.00				
364 KONTJNENDIJK-76								35.00				

THERMAL PROPERTIES

0 Reference	37 U3O8 mol%	38 UO2 mol%	39 PO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZrO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
313 GEISS-85							99.99			
314 GEISS-85							100.00			
315 GEISS-85							99.99			
316 GEISS-85							100.00			
317 KUBAYASHI-84				0.79	18.09		100.00			
318 KUBAYASHI-84					53.04		100.00			
319 KUBAYASHI-84				0.76	52.28		100.00			
320 KUBAYASHI-84					56.01		100.00			
321 KUBAYASHI-84				0.73	13.92		100.00			
322 KUNIJNENDIJK-76							100.00			
323 KUNIJNENDIJK-76							100.00			
324 KUNIJNENDIJK-76							100.00			
325 KUNIJNENDIJK-76							100.00			
326 KUNIJNENDIJK-76							100.00			
327 KUNIJNENDIJK-76							100.00			
328 KUNIJNENDIJK-76							100.00			
329 KUNIJNENDIJK-76							100.00			
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331 KUNIJNENDIJK-76							100.00			
332 KUNIJNENDIJK-76							100.00			
333 KUNIJNENDIJK-76							100.00			
334 KUNIJNENDIJK-76							100.00			
335 KUNIJNENDIJK-76							100.00			
336 KUNIJNENDIJK-76							100.00			
337 KUNIJNENDIJK-76							100.00			
338 KUNIJNENDIJK-76							100.00			
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356 KUNIJNENDIJK-76							100.00			
357 KUNIJNENDIJK-76							100.00			
358 KUNIJNENDIJK-76							100.00			
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360 KUNIJNENDIJK-76							100.00			
361 KUNIJNENDIJK-76							100.00			
362 KUNIJNENDIJK-76							100.00			
363 KUNIJNENDIJK-76							100.00			
364 KUNIJNENDIJK-76							100.00			

THERMAL PROPERTIES

9 Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
513 GEISS-85							
514 GEISS-85							
515 GEISS-85							
516 GEISS-85							
517 KUBAYASHI-84							
518 KUBAYASHI-84							
519 KUBAYASHI-84							
520 KUBAYASHI-84							
521 KUBAYASHI-84							
522 KUNIJIMOTO-IJK-76							
523 KUNIJIMOTO-IJK-76							
524 KUNIJIMOTO-IJK-76							
525 KUNIJIMOTO-IJK-76							
526 KUNIJIMOTO-IJK-76							
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563 KUNIJIMOTO-IJK-76							
564 KUNIJIMOTO-IJK-76							

THERMAL PROPERTIES

1 Reference	54 EC, T100P ohm.cm-1	55 Tc(Trans. Temp)°C	56 Tc(Soft. Temp)°C	57 T30P °C	58 T100P °C	59 T(10)4P °C	60 T(10)5P °C	61 T(10)6P °C	62 T(10)7P °C
313 GEISS-85									
314 GEISS-85									
315 GEISS-85									
316 GEISS-85									
317 KUBAYASHI-84		572					770	750.0	700
318 KUBAYASHI-84		560						660.0	630
319 KUBAYASHI-84		560					755	660.0	630
320 KUBAYASHI-84		565					724	665.0	635
321 KUBAYASHI-84		535					675	610.0	
322 KONIJNENDIJK-76			383						
323 KONIJNENDIJK-76			440						
324 KONIJNENDIJK-76			475						
325 KONIJNENDIJK-76			535						
326 KONIJNENDIJK-76			542						
327 KONIJNENDIJK-76			420						
328 KONIJNENDIJK-76			443						
329 KONIJNENDIJK-76			465						
330 KONIJNENDIJK-76			475						
331 KONIJNENDIJK-76			507						
332 KONIJNENDIJK-76			587						
333 KONIJNENDIJK-76			580						
334 KONIJNENDIJK-76			446						
335 KONIJNENDIJK-76			482						
336 KONIJNENDIJK-76			545						
337 KONIJNENDIJK-76			537						
338 KONIJNENDIJK-76			510						
339 KONIJNENDIJK-76			510						
340 KONIJNENDIJK-76			540						
341 KONIJNENDIJK-76			595						
342 KONIJNENDIJK-76			585						
343 KONIJNENDIJK-76			622						
344 KONIJNENDIJK-76			583						
345 KONIJNENDIJK-76			530						
346 KONIJNENDIJK-76									
347 KONIJNENDIJK-76			725						
348 KONIJNENDIJK-76			679						
349 KONIJNENDIJK-76			680						
350 KONIJNENDIJK-76			610						
351 KONIJNENDIJK-76			700						
352 KONIJNENDIJK-76			719						
353 KONIJNENDIJK-76			700						
354 KONIJNENDIJK-76			575						
355 KONIJNENDIJK-76			408						
356 KONIJNENDIJK-76			450						
357 KONIJNENDIJK-76			510						
358 KONIJNENDIJK-76			520						
359 KONIJNENDIJK-76			485						
360 KONIJNENDIJK-76			507						
361 KONIJNENDIJK-76			548						
362 KONIJNENDIJK-76			550						
363 KONIJNENDIJK-76			510						
364 KONIJNENDIJK-76			535						

THERMAL PROPERTIES

Reference	63 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
313 GEISS-85							
314 GEISS-85							
315 GEISS-85							
316 GEISS-85							
317 KUBAYASHI-84	617						
318 KUBAYASHI-84	580						
319 KUBAYASHI-84	585						
320 KUBAYASHI-84	585						
321 KUBAYASHI-84	565						
322 KONIJNENDIJK-76		290					
323 KONIJNENDIJK-76		340					
324 KONIJNENDIJK-76		385					
325 KONIJNENDIJK-76		480					
326 KONIJNENDIJK-76		485					
327 KONIJNENDIJK-76		315					
328 KONIJNENDIJK-76		350					
329 KONIJNENDIJK-76		365					
330 KONIJNENDIJK-76		375					
331 KONIJNENDIJK-76		413					
332 KONIJNENDIJK-76		495					
333 KONIJNENDIJK-76		518					
334 KONIJNENDIJK-76		335					
335 KONIJNENDIJK-76		380					
336 KONIJNENDIJK-76		460					
337 KONIJNENDIJK-76		457					
338 KONIJNENDIJK-76		340					
339 KONIJNENDIJK-76		355					
340 KONIJNENDIJK-76		375					
341 KONIJNENDIJK-76		400					
342 KONIJNENDIJK-76		445					
343 KONIJNENDIJK-76		525					
344 KONIJNENDIJK-76		520					
345 KONIJNENDIJK-76		455					
346 KONIJNENDIJK-76		495					
347 KONIJNENDIJK-76		545					
348 KONIJNENDIJK-76		562					
349 KONIJNENDIJK-76		582					
350 KONIJNENDIJK-76		500					
351 KONIJNENDIJK-76		485					
352 KONIJNENDIJK-76		512					
353 KONIJNENDIJK-76		532					
354 KONIJNENDIJK-76		470					
355 KONIJNENDIJK-76		325					
356 KONIJNENDIJK-76		370					
357 KONIJNENDIJK-76		437					
358 KONIJNENDIJK-76		450					
359 KONIJNENDIJK-76		395					
360 KONIJNENDIJK-76		422					
361 KONIJNENDIJK-76		460					
362 KONIJNENDIJK-76		480					
363 KONIJNENDIJK-76		345					
364 KONIJNENDIJK-76		370					

THERMAL PROPERTIES

Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc, Poise	74 Other Visc, Poise	75 Other Visc, Poise
313 GEISS-85				At 926 C, 8.91e+08		At 902 C, 5.50e+09
314 GEISS-85				At 850 C, 1.78e+10	At 860 C, 1.00e+10	At 905 C, 3.98e+08
315 GEISS-85				At 850 C, 1.86e+10	At 870 C, 3.55e+09	
316 GEISS-85				At 880 C, 1.78e+10	At 860 C, 1.00e+10	
317 KUBAYASHI-84						
318 KUBAYASHI-84						
319 KUBAYASHI-84						
320 KUBAYASHI-84						
321 KUBAYASHI-84						
322 KUNIJNENDIJK-76						
323 KUNIJNENDIJK-76						
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364 KUNIJNENDIJK-76						

THERMAL PROPERTIES

0 Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
313 GEISS-85	At 885 C, 1.74e+10	At 910 C, 2.82e+09				
314 GEISS-85	At 888 C, 1.26e+09	At 920 C, 2.54e+08				
315 GEISS-85	At 890 C, 8.91e+08	At 910 C, 2.34e+08				
316 GEISS-85						
317 KUBAYASHI-84						
318 KUBAYASHI-84						
319 KUBAYASHI-84						
320 KUBAYASHI-84						
321 KUBAYASHI-84						
322 KONIJNENDIJK-76						
323 KONIJNENDIJK-76						
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364 KONIJNENDIJK-76						

THERMAL PROPERTIES

0 Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th. Exp. Lin. Coeff.
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313 GEISS-85				
314 GEISS-85				
315 GEISS-85				
316 GEISS-85				
317 KURAYASHI-84				
318 KURAYASHI-84				
319 KURAYASHI-84				
320 KURAYASHI-84				
321 KURAYASHI-84				
322 KONTJNENDIJK-76				
323 KONTJNENDIJK-76				
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364 KONTJNENDIJK-76				

THERMAL PROPERTIES

0 Reference	1 Glass ID or Data Source	2 Al ₂ O ₃ mol%	3 AlN mol%	4 B ₂ O ₃ mol%	5 BaO mol%	6 BeO mol%	7 CaO mol%	8 CeO ₂ mol%	9 Cr ₂ O ₃ mol%	10 Cs ₂ O mol%	11 CuO mol%	12 F mol%
365	KONTJNENDIJK-76 Fig. 4,12			55.00								
366	KONTJNENDIJK-76 Fig. 4,12			50.00								
367	KONTJNENDIJK-76 Fig. 4,12			45.00								
368	KONTJNENDIJK-76 Fig. 4			34.00								
369	KONTJNENDIJK-76 Fig. 4,12			25.00								
370	KONTJNENDIJK-76 Fig. 4,12			15.00								
371	KONTJNENDIJK-76 Fig. 4,12			5.00								
372	KONTJNENDIJK-76 Fig. 5			60.00								
373	KONTJNENDIJK-76 Fig. 5			78.00								
374	KONTJNENDIJK-76 Fig. 5			75.00								
375	KONTJNENDIJK-76 Fig. 5			65.00								
376	KONTJNENDIJK-76 Fig. 5			55.00								
377	KONTJNENDIJK-76 Fig. 5			45.00								
378	KONTJNENDIJK-76 Fig. 6	4.76		78.10								
379	KONTJNENDIJK-76 Fig. 6	4.76		71.43								
380	KONTJNENDIJK-76 Fig. 6	4.76		66.67								
381	KONTJNENDIJK-76 Fig. 6	4.76		61.90								
382	KONTJNENDIJK-76 Fig. 6	4.76		52.38								
383	KONTJNENDIJK-76 Fig. 6	4.76		28.57								
384	KONTJNENDIJK-76 Fig. 6	4.76		23.81								
385	KONTJNENDIJK-76 Fig. 6	4.76		14.29								
386	KONTJNENDIJK-76 Fig. 6	4.76		4.76								
387	KONTJNENDIJK-76 Fig. 7	4.76		78.10								
388	KONTJNENDIJK-76 Fig. 7	4.76		71.43								
389	KONTJNENDIJK-76 Fig. 7	4.76		66.67								
390	KONTJNENDIJK-76 Fig. 7	4.76		61.90								
391	KONTJNENDIJK-76 Fig. 7	4.76		52.38								
392	KONTJNENDIJK-76 Fig. 7	4.76		32.38								
393	KONTJNENDIJK-76 Fig. 7	4.76		28.57								
394	KONTJNENDIJK-76 Fig. 7	4.76		23.81								
395	KONTJNENDIJK-76 Fig. 7	4.76		14.29								
396	KONTJNENDIJK-76 Fig. 7	4.76		4.76								
397	KONTJNENDIJK-76 Fig. 8	4.76		78.10								
398	KONTJNENDIJK-76 Fig. 8	4.76		71.43								
399	KONTJNENDIJK-76 Fig. 8	4.76		66.67								
400	KONTJNENDIJK-76 Fig. 8	4.76		52.38								
401	KONTJNENDIJK-76 Fig. 8	4.76		28.57								
402	KONTJNENDIJK-76 Fig. 8	4.76		23.81								
403	KONTJNENDIJK-76 Fig. 8	4.76		4.76								
404	KONTJNENDIJK-76 Fig. 9			70.00								
405	KONTJNENDIJK-76 Fig. 10			33.00								
406	KONTJNENDIJK-76 Fig. 11			82.00								
407	KONTJNENDIJK-76 Fig. 2,10			35.00								
408	KONTJNENDIJK-76 Tab. 1			65.00								
409	KONTJNENDIJK-76 Tab. 1	4.76		61.90								
410	KONTJNENDIJK-76 Tab. 1	9.09		59.09								
411	KONTJNENDIJK-76 Tab. 1	13.04		56.52								
412	KONTJNENDIJK-76 Tab. 1	16.67		54.17								
413	KONTJNENDIJK-76 Tab. 1, Fig. 2,10			15.00								
414	KONTJNENDIJK-76 Tab. 1, Fig. 8	4.76		14.29								
415	KONTJNENDIJK-76 Tab. 1	9.09		13.64								
416	KONTJNENDIJK-76 Tab. 1	13.04		13.04								

THERMAL PROPERTIES

0 Reference	13 Fe2O3 mol%	14 Ga2O3 mol%	15 GeO2 mol%	16 K2O mol%	17 Li2O mol%	18 MgO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
365 KONTJNEHOTJK-76				10.00								
366 KONTJNEHOTJK-76				15.00								
367 KONTJNEHOTJK-76				20.00								
368 KONTJNEHOTJK-76				1.00								
369 KONTJNEHOTJK-76				10.00								
370 KONTJNEHOTJK-76				20.00								
371 KONTJNEHOTJK-76				30.00								
372 KONTJNEHOTJK-76					5.00							
373 KONTJNEHOTJK-76					7.00							
374 KONTJNEHOTJK-76					10.00							
375 KONTJNEHOTJK-76					20.00							
376 KONTJNEHOTJK-76					30.00							
377 KONTJNEHOTJK-76					40.00							
378 KONTJNEHOTJK-76										2.86		
379 KONTJNEHOTJK-76										9.52		
380 KONTJNEHOTJK-76										14.29		
381 KONTJNEHOTJK-76										19.05		
382 KONTJNEHOTJK-76										28.57		
383 KONTJNEHOTJK-76										4.76		
384 KONTJNEHOTJK-76										9.52		
385 KONTJNEHOTJK-76										19.05		
386 KONTJNEHOTJK-76										28.57		
387 KONTJNEHOTJK-76				2.86								
388 KONTJNEHOTJK-76				9.52								
389 KONTJNEHOTJK-76				14.29								
390 KONTJNEHOTJK-76				19.05								
391 KONTJNEHOTJK-76				28.57								
392 KONTJNEHOTJK-76				0.95								
393 KONTJNEHOTJK-76				4.76								
394 KONTJNEHOTJK-76				9.52								
395 KONTJNEHOTJK-76				19.05								
396 KONTJNEHOTJK-76				28.57								
397 KONTJNEHOTJK-76				1.43						1.43		
398 KONTJNEHOTJK-76				4.76						4.76		
399 KONTJNEHOTJK-76				7.14						7.14		
400 KONTJNEHOTJK-76				14.29						14.29		
401 KONTJNEHOTJK-76				2.38						2.38		
402 KONTJNEHOTJK-76				4.76						4.76		
403 KONTJNEHOTJK-76				14.29						14.29		
404 KONTJNEHOTJK-76				7.50						7.50		
405 KONTJNEHOTJK-76										2.00		
406 KONTJNEHOTJK-76				3.00								
407 KONTJNEHOTJK-76				0.00						0.00		
408 KONTJNEHOTJK-76				10.00						10.00		
409 KONTJNEHOTJK-76				9.52						9.52		
410 KONTJNEHOTJK-76				9.09						9.09		
411 KONTJNEHOTJK-76				8.70						8.70		
412 KONTJNEHOTJK-76				8.33						8.33		
413 KONTJNEHOTJK-76				10.00						10.00		
414 KONTJNEHOTJK-76				9.52						9.52		
415 KONTJNEHOTJK-76				9.09						9.09		
416 KONTJNEHOTJK-76				8.70						8.70		

THERMAL PROPERTIES

0 Reference	25 P2O5 mol%	26 PbO mol%	27 PdO mol%	28 Pb2O mol%	29 Rh2O3 mol%	30 RuO2 mol%	31 SO3 mol%	32 SiO2 mol%	33 SrO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
365 KUNIJHENDIJK-76								35.00				
366 KUNIJHENDIJK-76								35.00				
367 KUNIJHENDIJK-76								35.00				
368 KUNIJHENDIJK-76								65.00				
369 KUNIJHENDIJK-76								65.00				
370 KUNIJHENDIJK-76								65.00				
371 KUNIJHENDIJK-76								65.00				
372 KUNIJHENDIJK-76								15.00				
373 KUNIJHENDIJK-76								15.00				
374 KUNIJHENDIJK-76								15.00				
375 KUNIJHENDIJK-76								15.00				
376 KUNIJHENDIJK-76								15.00				
377 KUNIJHENDIJK-76								15.00				
378 KUNIJHENDIJK-76								14.29				
379 KUNIJHENDIJK-76								14.29				
380 KUNIJHENDIJK-76								14.29				
381 KUNIJHENDIJK-76								14.29				
382 KUNIJHENDIJK-76								14.29				
383 KUNIJHENDIJK-76								61.90				
384 KUNIJHENDIJK-76								61.90				
385 KUNIJHENDIJK-76								61.90				
386 KUNIJHENDIJK-76								61.90				
387 KUNIJHENDIJK-76								14.29				
388 KUNIJHENDIJK-76								14.29				
389 KUNIJHENDIJK-76								14.29				
390 KUNIJHENDIJK-76								14.29				
391 KUNIJHENDIJK-76								14.29				
392 KUNIJHENDIJK-76								61.90				
393 KUNIJHENDIJK-76								61.90				
394 KUNIJHENDIJK-76								61.90				
395 KUNIJHENDIJK-76								61.90				
396 KUNIJHENDIJK-76								61.90				
397 KUNIJHENDIJK-76								14.29				
398 KUNIJHENDIJK-76								14.29				
399 KUNIJHENDIJK-76								14.29				
400 KUNIJHENDIJK-76								14.29				
401 KUNIJHENDIJK-76								61.90				
402 KUNIJHENDIJK-76								61.90				
403 KUNIJHENDIJK-76								61.90				
404 KUNIJHENDIJK-76								61.90				
405 KUNIJHENDIJK-76								15.00				
406 KUNIJHENDIJK-76								65.00				
407 KUNIJHENDIJK-76								15.00				
408 KUNIJHENDIJK-76								65.00				
409 KUNIJHENDIJK-76								15.00				
410 KUNIJHENDIJK-76								14.29				
411 KUNIJHENDIJK-76								13.64				
412 KUNIJHENDIJK-76								13.64				
413 KUNIJHENDIJK-76								12.50				
414 KUNIJHENDIJK-76								65.00				
415 KUNIJHENDIJK-76								61.90				
416 KUNIJHENDIJK-76								59.09				
								56.52				

THERMAL PROPERTIES

0 Reference	37 U3O8 mol%	38 UO2 mol%	39 UO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZnO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
365 KONIJNEHOIJK-76							100.00			
366 KONIJNEHOIJK-76							100.00			
367 KONIJNEHOIJK-76							100.00			
368 KONIJNEHOIJK-76							100.00			
369 KONIJNEHOIJK-76							100.00			
370 KONIJNEHOIJK-76							100.00			
371 KONIJNEHOIJK-76							100.00			
372 KONIJNEHOIJK-76							100.00			
373 KONIJNEHOIJK-76							100.00			
374 KONIJNEHOIJK-76							100.00			
375 KONIJNEHOIJK-76							100.00			
376 KONIJNEHOIJK-76							100.00			
377 KONIJNEHOIJK-76							100.00			
378 KONIJNEHOIJK-76							105.00			
379 KONIJNEHOIJK-76							105.00			
380 KONIJNEHOIJK-76							105.00			
381 KONIJNEHOIJK-76							105.00			
382 KONIJNEHOIJK-76							105.00			
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387 KONIJNEHOIJK-76							105.00			
388 KONIJNEHOIJK-76							105.00			
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403 KONIJNEHOIJK-76							105.00			
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408 KONIJNEHOIJK-76							100.00			
409 KONIJNEHOIJK-76							105.00			
410 KONIJNEHOIJK-76							110.00			
411 KONIJNEHOIJK-76							115.00			
412 KONIJNEHOIJK-76							120.00			
413 KONIJNEHOIJK-76							100.00			
414 KONIJNEHOIJK-76							105.00			
415 KONIJNEHOIJK-76							110.00			
416 KONIJNEHOIJK-76							115.00			

THERMAL PROPERTIES

Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
365 KONIJNEENDIJK-76							
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416 KONIJNEENDIJK-76							

THERMAL PROPERTIES

0 Reference	54 E_C , 1100P ohm, cm-1	55 I_q (Trans. Temp)°C	56 T_g (Soft. Temp)°C	57 T_{30P} °C	58 T_{100P} °C	59 $T(10)4P$ °C	60 $T(10)5P$ °C	61 $T(10)6P$ °C	62 $T(10)7P$ °C
365 KUNIJNENDIJK-76			530						
366 KUNIJNENDIJK-76			580						
367 KUNIJNENDIJK-76			610						
368 KUNIJNENDIJK-76									
369 KUNIJNENDIJK-76			710						
370 KUNIJNENDIJK-76			735						
371 KUNIJNENDIJK-76			655						
372 KUNIJNENDIJK-76									
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404 KUNIJNENDIJK-76			517						
405 KUNIJNENDIJK-76			715						
406 KUNIJNENDIJK-76			435						
407 KUNIJNENDIJK-76			700						
408 KUNIJNENDIJK-76			544						
409 KUNIJNENDIJK-76			541						
410 KUNIJNENDIJK-76			532						
411 KUNIJNENDIJK-76			535						
412 KUNIJNENDIJK-76			545						
413 KUNIJNENDIJK-76			645						
414 KUNIJNENDIJK-76			683						
415 KUNIJNENDIJK-76			703						
416 KUNIJNENDIJK-76			704						

THERMAL PROPERTIES

Reference	65 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
365 KONIJNENDIJK-76		430					
366 KONIJNENDIJK-76		470					
367 KONIJNENDIJK-76		515					
368 KONIJNENDIJK-76		495					
369 KONIJNENDIJK-76		570					
370 KONIJNENDIJK-76		630					
371 KONIJNENDIJK-76		535					
372 KONIJNENDIJK-76		367					
373 KONIJNENDIJK-76		385					
374 KONIJNENDIJK-76		415					
375 KONIJNENDIJK-76		502					
376 KONIJNENDIJK-76		510					
377 KONIJNENDIJK-76		485					
378 KONIJNENDIJK-76		392					
379 KONIJNENDIJK-76		407					
380 KONIJNENDIJK-76		435					
381 KONIJNENDIJK-76		475					
382 KONIJNENDIJK-76		493					
383 KONIJNENDIJK-76		497					
384 KONIJNENDIJK-76		537					
385 KONIJNENDIJK-76		590					
386 KONIJNENDIJK-76		512					
387 KONIJNENDIJK-76		375					
388 KONIJNENDIJK-76		400					
389 KONIJNENDIJK-76		430					
390 KONIJNENDIJK-76		470					
391 KONIJNENDIJK-76		473					
392 KONIJNENDIJK-76		552					
393 KONIJNENDIJK-76		500					
394 KONIJNENDIJK-76		542					
395 KONIJNENDIJK-76		650					
396 KONIJNENDIJK-76		575					
397 KONIJNENDIJK-76		360					
398 KONIJNENDIJK-76		370					
399 KONIJNENDIJK-76		420					
400 KONIJNENDIJK-76		463					
401 KONIJNENDIJK-76		490					
402 KONIJNENDIJK-76		520					
403 KONIJNENDIJK-76		495					
404 KONIJNENDIJK-76							
405 KONIJNENDIJK-76							
406 KONIJNENDIJK-76							
407 KONIJNENDIJK-76		475					
408 KONIJNENDIJK-76		459					
409 KONIJNENDIJK-76		454					
410 KONIJNENDIJK-76		440					
411 KONIJNENDIJK-76		435					
412 KONIJNENDIJK-76		450					
413 KONIJNENDIJK-76		563					
414 KONIJNENDIJK-76		562					
415 KONIJNENDIJK-76		568					
416 KONIJNENDIJK-76		574					

THERMAL PROPERTIES

Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
365 KONTJNENDIJK-76						
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416 KONTJNENDIJK-76						

THERMAL PROPERTIES

0 Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
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THERMAL PROPERTIES

0 Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th. Exp. Lin. Coeff.
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365 KONIJNENDIJK-76				
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414 KONIJNENDIJK-76				
415 KONIJNENDIJK-76				
416 KONIJNENDIJK-76				

THERMAL PROPERTIES

U Reference	1 Glass ID or Data Source	2 Al ₂ O ₃ mol%	3 AlN mol%	4 H ₂ O ₃ mol%	5 BaO mol%	6 BeO mol%	7 CaO mol%	8 CeO ₂ mol%	9 Cr ₂ O ₃ mol%	10 CaO mol%	11 CuO mol%	12 F mol%
417 KONTJENHOLJK-76	Tab. 1	16.67		12.50								
418 KUPPINGER-85	#1			100.00								
419 KUPPINGER-85	#2			70.00								
420 KUPPINGER-85	#3			70.00								
421 KUPPINGER-85	#4			70.00								
422 KUPPINGER-85	#5			70.00								
423 KUPPINGER-85	#6			70.00								
424 KUPPINGER-85	#7			70.00								
425 KUPPINGER-85	#8			70.00								
426 KUPPINGER-85	#9			70.00								
427 KUPPINGER-85	#10			70.00								
428 KUPPINGER-85	#11			70.00								
429 KUPPINGER-85	#12			70.00								
430 KUPPINGER-85	#13			80.00								
431 KUPPINGER-85	#14			90.91								
432 KUPPINGER-85	#15			83.33								
433 KUPPINGER-85	#16			80.00								
434 KUPPINGER-85	#17			76.92								
435 KUPPINGER-85	#18			71.43								
436 KUPPINGER-85	#19			66.67								
437 KUPPINGER-85	#20			95.00								
438 KUPPINGER-85	#21			90.00								
439 KUPPINGER-85	#22			85.00								
440 KUPPINGER-85	#23			75.00								
441 KUPPINGER-85	#24			65.00								
442 KUPPINGER-85	#25			95.00								
443 KUPPINGER-85	#26			90.00								
444 KUPPINGER-85	#27			85.00								
445 KUPPINGER-85	#28			75.00								
446 KUPPINGER-85	#29			65.00								
447 LAKATOS-76	S1	0.11					10.87					
448 LAKATOS-76	S2	5.01					11.58					
449 LAKATOS-76	S3	3.64					13.21					
450 LAKATOS-76	S4	2.42					10.56					
451 LAKATOS-76	S5	1.36					12.32					
452 LAKATOS-76	S6	2.41					14.32					
453 LAKATOS-76	S7	1.32					11.00					
454 LAKATOS-76	S8	0.21					12.75					
455 LAKATOS-76	S9	4.39					9.54					
456 LAKATOS-76	S10	3.32					11.30					
457 LAKATOS-76	S11	4.41					12.90					
458 LAKATOS-76	S12	3.23					9.61					
459 LAKATOS-76	S13	2.03					11.69					
460 LAKATOS-76	S14	1.37					13.34					
461 LAKATOS-76	S15						10.54					
462 LAKATOS-76	S16	1.32					11.86					
463 LAKATOS-76	S17	0.02					13.98					
464 LAKATOS-76	S18	4.42					10.57					
465 LAKATOS-76	S19	3.11					11.58					
466 LAKATOS-76	S20	2.20					9.56					
467 LAKATOS-76	S21	3.26					10.62					
468 LAKATOS-76	S22	2.51					12.39					

THERMAL PROPERTIES

Reference	13 Fe2O3 mol%	14 Ga2O3 mol%	15 GeO2 mol%	16 K2O mol%	17 Li2O mol%	18 MgO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
417 KUPPINGER-85-76				8.33						8.33		
418 KUPPINGER-85				0.00						0.00		
419 KUPPINGER-85				0.00						30.00		
420 KUPPINGER-85				3.00						27.00		
421 KUPPINGER-85				6.00						24.00		
422 KUPPINGER-85				9.00						21.00		
423 KUPPINGER-85				12.00						18.00		
424 KUPPINGER-85				15.00						15.00		
425 KUPPINGER-85				18.00						12.00		
426 KUPPINGER-85				21.00						9.00		
427 KUPPINGER-85				24.00						6.00		
428 KUPPINGER-85				27.00						3.00		
429 KUPPINGER-85				30.00						0.00		
430 KUPPINGER-85				0.00						20.00		
431 KUPPINGER-85				4.55						4.55		
432 KUPPINGER-85				8.33						8.33		
433 KUPPINGER-85				10.00						10.00		
434 KUPPINGER-85				11.54						11.54		
435 KUPPINGER-85				14.29						14.29		
436 KUPPINGER-85				16.67						16.67		
437 KUPPINGER-85				2.50						2.50		
438 KUPPINGER-85				5.00						5.00		
439 KUPPINGER-85				7.50						7.50		
440 KUPPINGER-85				12.50						12.50		
441 KUPPINGER-85				17.50						17.50		
442 KUPPINGER-85				0.00						5.00		
443 KUPPINGER-85				0.00						10.00		
444 KUPPINGER-85				0.00						15.00		
445 KUPPINGER-85				0.00						25.00		
446 KUPPINGER-85				0.00						35.00		
447 LAKATOS-76				0.08						11.69		
448 LAKATOS-76				1.48		2.58				10.76		
449 LAKATOS-76				2.64		1.14				10.58		
450 LAKATOS-76				4.10		3.30				10.82		
451 LAKATOS-76				5.43		1.92				10.48		
452 LAKATOS-76				0.01		2.77				11.54		
453 LAKATOS-76				1.69		1.17				12.26		
454 LAKATOS-76				2.84		3.24				11.76		
455 LAKATOS-76				4.04		1.86				11.45		
456 LAKATOS-76				5.63						11.50		
457 LAKATOS-76				0.02		0.98				12.63		
458 LAKATOS-76				1.50		3.51				12.50		
459 LAKATOS-76				2.81		1.83				12.63		
460 LAKATOS-76				4.27						12.46		
461 LAKATOS-76				5.69		2.57				12.58		
462 LAKATOS-76				0.03		3.33				13.65		
463 LAKATOS-76				1.51		1.63				13.45		
464 LAKATOS-76				2.93						13.63		
465 LAKATOS-76				4.10		2.64				12.78		
466 LAKATOS-76				5.04		1.12				13.56		
467 LAKATOS-76				0.01		1.90				15.07		
468 LAKATOS-76				1.57						14.52		

THERMAL PROPERTIES

Reference	25 P2O5 mol%	26 PbO mol%	27 PdO mol%	28 Rb2O mol%	29 Rh2O3 mol%	30 RuO2 mol%	31 SO3 mol%	32 SiO2 mol%	33 SrO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
417 KUNIJIMOTOJK-76								54.17				
418 KUPPINGER-85												
419 KUPPINGER-85												
420 KUPPINGER-85												
421 KUPPINGER-85												
422 KUPPINGER-85												
423 KUPPINGER-85												
424 KUPPINGER-85												
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443 KUPPINGER-85												
444 KUPPINGER-85												
445 KUPPINGER-85												
446 KUPPINGER-85												
447 LAKATOS-76								77.24				
448 LAKATOS-76								68.60				
449 LAKATOS-76								68.79				
450 LAKATOS-76								68.80				
451 LAKATOS-76								68.48				
452 LAKATOS-76								68.95				
453 LAKATOS-76								72.57				
454 LAKATOS-76								69.20				
455 LAKATOS-76								68.72				
456 LAKATOS-76								68.25				
457 LAKATOS-76								69.06				
458 LAKATOS-76								69.66				
459 LAKATOS-76								69.01				
460 LAKATOS-76								68.57				
461 LAKATOS-76								68.62				
462 LAKATOS-76								69.82				
463 LAKATOS-76								69.43				
464 LAKATOS-76								68.46				
465 LAKATOS-76								65.69				
466 LAKATOS-76								68.13				
467 LAKATOS-76								69.14				
468 LAKATOS-76								69.02				

THERMAL PROPERTIES

0 Reference	37 H309 mol%	38 H012 mol%	39 H013 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZnO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
417 KUPPINGER-85							120.00			
418 KUPPINGER-85							100.00			
419 KUPPINGER-85							100.00			
420 KUPPINGER-85							100.00			
421 KUPPINGER-85							100.00			
422 KUPPINGER-85							100.00			
423 KUPPINGER-85							100.00			
424 KUPPINGER-85							100.00			
425 KUPPINGER-85							100.00			
426 KUPPINGER-85							100.00			
427 KUPPINGER-85							100.00			
428 KUPPINGER-85							100.00			
429 KUPPINGER-85							100.00			
430 KUPPINGER-85							100.00			
431 KUPPINGER-85							88.00			
432 KUPPINGER-85							96.00			
433 KUPPINGER-85							100.00			
434 KUPPINGER-85							104.00			
435 KUPPINGER-85							112.00			
436 KUPPINGER-85							120.00			
437 KUPPINGER-85							100.00			
438 KUPPINGER-85							100.00			
439 KUPPINGER-85							100.00			
440 KUPPINGER-85							100.00			
441 KUPPINGER-85							100.00			
442 KUPPINGER-85							100.00			
443 KUPPINGER-85							100.00			
444 KUPPINGER-85							100.00			
445 KUPPINGER-85							100.00			
446 KUPPINGER-85							100.00			
447 LAKATOS-76							100.00			
448 LAKATOS-76							100.00			
449 LAKATOS-76							100.00			
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466 LAKATOS-76							100.00			
467 LAKATOS-76							100.00			
468 LAKATOS-76							100.00			

THERMAL PROPERTIES

Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
417 KUPPINGER-85							
418 KUPPINGER-85							
419 KUPPINGER-85							
420 KUPPINGER-85							
421 KUPPINGER-85							
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467 LAKATOS-76							
468 LAKATOS-76							

THERMAL PROPERTIES

0 Reference	54 LC, T100P ohm.cm-1	55 Tq(Trans. Temp)oC	56 Ts(Soft. Temp)oC	57 T30P oC	58 T100P oC	59 T(10)4P oC	60 T(10)5P oC	61 T(10)6P oC	62 T(10)7P oC
417 KONTJENETJK-76			777						
418 KUPPINGER-85									
419 KUPPINGER-85									
420 KUPPINGER-85									
421 KUPPINGER-85									
422 KUPPINGER-85									
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445 KUPPINGER-85									
446 KUPPINGER-85									
447 LAKATOS-76					1503.7	1054.3		843.3	
448 LAKATOS-76					1535.0	1089.0		877.2	
449 LAKATOS-76					1478.2	1054.2		853.4	
450 LAKATOS-76					1455.3	1034.4		831.1	
451 LAKATOS-76					1402.5	1002.9		810.1	
452 LAKATOS-76					1446.0	1044.9		853.1	
453 LAKATOS-76					1465.9	1034.0		829.9	
454 LAKATOS-76					1382.5	996.2		809.0	
455 LAKATOS-76					1509.9	1058.2		844.6	
456 LAKATOS-76					1445.5	1017.2		815.9	
457 LAKATOS-76					1499.0	1063.7		861.2	
458 LAKATOS-76					1494.3	1055.0		845.5	
459 LAKATOS-76					1424.3	1012.5		817.0	
460 LAKATOS-76					1375.1	981.3		795.9	
461 LAKATOS-76					1355.9	964.2		775.1	
462 LAKATOS-76					1422.7	1017.8		824.6	
463 LAKATOS-76					1357.8	978.7		798.5	
464 LAKATOS-76					1479.5	1033.4		827.7	
465 LAKATOS-76					1400.8	1000.3		809.2	
466 LAKATOS-76					1405.0	984.9		786.9	
467 LAKATOS-76					1458.9	1028.0		827.5	
468 LAKATOS-76					1412.9	999.8		808.8	

THERMAL PROPERTIES

0 Reference	63 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
417 KONTJNEBOLJK-76			612				
418 KUPPINGER-85	281		265				
419 KUPPINGER-85	480		478				
420 KUPPINGER-85	474		462				
421 KUPPINGER-85	463		451				
422 KUPPINGER-85	353		442				
423 KUPPINGER-85	447		435				
424 KUPPINGER-85	442		430				
425 KUPPINGER-85	439		427				
426 KUPPINGER-85	437		426				
427 KUPPINGER-85	439		427				
428 KUPPINGER-85	443		432				
429 KUPPINGER-85	458		447				
430 KUPPINGER-85	474		459				
431 KUPPINGER-85	455		440				
432 KUPPINGER-85	446		431				
433 KUPPINGER-85	440		424				
434 KUPPINGER-85	440		425				
435 KUPPINGER-85	429		415				
436 KUPPINGER-85	437		423				
437 KUPPINGER-85	326		307				
438 KUPPINGER-85	371		353				
439 KUPPINGER-85	414		396				
440 KUPPINGER-85	447		433				
441 KUPPINGER-85	423		412				
442 KUPPINGER-85							
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447 LAKATOS-76							
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468 LAKATOS-76							

THERMAL PROPERTIES

Reference	70 Visc, 1250 C Poise	71 Visc, 1500 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
417 KONIJMER-76						
418 KUPPINGER-85						
419 KUPPINGER-85						
420 KUPPINGER-85						
421 KUPPINGER-85						
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468 LAKATOS-76						

THERMAL PROPERTIES

Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
417 KUPPINGER-85						
418 KUPPINGER-85						
419 KUPPINGER-85						
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468 LAKATOS-76						

THERMAL PROPERTIES

0 Reference	02 Other Visc. Poise	03 Other Visc. Poise	04 Other Visc. Poise	05 Th.Exp. Lin.Coeff.
417 KUPPINGER-85				14.10 Kuppinger
418 KUPPINGER-85				11.10 Th.Exp.Coeff.
419 KUPPINGER-85				are X(10)6/oK
420 KUPPINGER-85				
421 KUPPINGER-85				
422 KUPPINGER-85				
423 KUPPINGER-85				
424 KUPPINGER-85				13.70
425 KUPPINGER-85				
426 KUPPINGER-85				
427 KUPPINGER-85				
428 KUPPINGER-85				
429 KUPPINGER-85				9.25
430 KUPPINGER-85				
431 KUPPINGER-85				
432 KUPPINGER-85				
433 KUPPINGER-85				11.30
434 KUPPINGER-85				
435 KUPPINGER-85				
436 KUPPINGER-85				
437 KUPPINGER-85				12.40
438 KUPPINGER-85				11.60
439 KUPPINGER-85				11.30
440 KUPPINGER-85				12.40
441 KUPPINGER-85				
442 KUPPINGER-85				12.00
443 KUPPINGER-85				10.50
444 KUPPINGER-85				9.60
445 KUPPINGER-85				9.50
446 KUPPINGER-85				12.50
447 LAKATOS-76				
448 LAKATOS-76				
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468 LAKATOS-76				

THERMAL PROPERTIES

0 Reference	1 Glass ID or Data Source	2 Al ₂ O ₃ mol%	3 AlN mol%	4 B ₂ O ₃ mol%	5 BaO mol%	6 BeO mol%	7 CaO mol%	8 CeO ₂ mol%	9 Cr ₂ O ₃ mol%	10 CaF ₂ mol%	11 CuO mol%	12 F mol%
469 LAKATOS-76	S23	1.17					9.64					
470 LAKATOS-76	S24	0.22					11.57					
471 LAKATOS-76	S25	4.14					12.28					
472 LAKATOS-76	S26	1.29					10.85					
473 LAKATOS-76	S27	1.42					9.03					
474 LAKATOS-76	S28	1.20					12.04					
475 LAKATOS-76	S29	1.30					9.72					
476 LAKATOS-76	S30	1.39					11.33					
477 LAKATOS-76	D1	0.73					13.05					
478 LAKATOS-76	D2	0.72					13.04					
479 LAKATOS-76	D3	0.73					13.05					
480 LAKATOS-76	D4	0.72					13.05					
481 LAKATOS-76	D5	0.72			3.62		9.42					
482 LAKATOS-76	D6	0.73			7.28		5.39					
483 LAKATOS-76	D7	0.71					10.71					
484 LAKATOS-76	D8	0.72					7.14					
485 LAKATOS-76	D9	0.71		1.78			12.82					
486 LAKATOS-76	D10	0.70		3.50			12.59					
487 LAKATOS-76	D13	0.72					11.23					
488 LAKATOS-76	D14	0.73					8.99					
489 LAKATOS-76	D15	0.69		5.15			12.37					
490 LAKATOS-76	D17	0.63		12.66			11.39					
491 LAKATOS-76	F2	0.97		0.24			10.91					
492 LAKATOS-76	F3	1.00		0.43			10.90					
493 LAKATOS-76	F4	0.98					10.97					
494 LAKATOS-76	F5	0.97		0.23			11.11					
495 LAKATOS-76	F6	0.97		0.48			11.08					
496 LAKATOS-76	F7	0.98					10.86					
497 LAKATOS-76	F8	0.93		0.25			10.76					
498 LAKATOS-76	F9	0.93		0.39			10.77					
499 LAKATOS-76	F10	0.95					10.77					
500 LAKATOS-76	F11	0.94		0.26			10.76					
501 LAKATOS-76	F12	0.97		0.40			10.77					
502 LAKATOS-76	F13	0.97					11.09					
503 LAKATOS-76	F14	0.93					10.86					
504 LAKATOS-76	F15	0.92					10.48					
505 LAKATOS-76	FAL 1	1.18					11.84					
506 LAKATOS-76	FAL 2	3.61					14.20					
507 LAKATOS-76	FAL 3	3.57					11.92					
508 LAKATOS-76	FAL 4	3.63					14.30					
509 LAKATOS-76	FAL 5	3.60					12.00					
510 LAKATOS-76	FAL 6	3.62					12.05					
511 LAKATOS-76	FAL 7	3.61					14.21					
512 LAKATOS-76	FAL 8	3.58					11.92					
513 LAKATOS-76	FAL 9	3.63					14.31					
514 LAKATOS-76	FAL 10	3.60					12.00					
515 LAKATOS-76	FAL 11	1.17					9.56					
516 LAKATOS-76	FAL 12	1.15					7.34					
517 LAKATOS-76	FAL 13	1.17					10.32					
518 LAKATOS-76	FAL 14	1.16					8.08					
519 PLUDJIEC-78	Frit 18	0.00		9.01			5.59					
420 PLUDJIEC-78	Frit 18, 25 III	1.00		7.83			6.22					

THERMAL PROPERTIES

# Reference	13 Fe2O3 mol%	14 Cd2O3 mol%	15 GeO2 mol%	16 K2O mol%	17 Li2O mol%	18 HgO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
469 LAKATOS-76				2.86		2.64				14.69		
470 LAKATOS-76				4.18		0.82				14.52		
471 LAKATOS-76				5.06		3.08				13.32		
472 LAKATOS-76				1.60		2.98				10.92		
473 LAKATOS-76				4.46		1.95				11.92		
474 LAKATOS-76				0.05		0.98				12.61		
475 LAKATOS-76				3.02						13.75		
476 LAKATOS-76				5.17		3.38				13.57		
477 LAKATOS-76										13.76		
478 LAKATOS-76					0.36					13.41		
479 LAKATOS-76					1.08					12.68		
480 LAKATOS-76					2.17					11.59		
481 LAKATOS-76										13.77		
482 LAKATOS-76										13.82		
483 LAKATOS-76										13.57		
484 LAKATOS-76										13.57		
485 LAKATOS-76										13.52		
486 LAKATOS-76										13.28		
487 LAKATOS-76										13.77		
488 LAKATOS-76										13.83		
489 LAKATOS-76										13.05		
490 LAKATOS-76										12.02		
491 LAKATOS-76				0.32						13.48		
492 LAKATOS-76				0.32						13.58		
493 LAKATOS-76				0.32	2.00					12.44		
494 LAKATOS-76				0.31	2.01					12.67		
495 LAKATOS-76				0.30	2.10					12.63		
496 LAKATOS-76				0.30	4.06					11.55		
497 LAKATOS-76				0.30	4.06					11.45		
498 LAKATOS-76				0.31	3.96					11.47		
499 LAKATOS-76				0.30	5.88					10.59		
500 LAKATOS-76				0.31	5.88					10.68		
501 LAKATOS-76				0.29	5.89					10.69		
502 LAKATOS-76				0.31	2.00					13.41		
503 LAKATOS-76				0.28	3.96					13.08		
504 LAKATOS-76				0.29	5.31					13.18		
505 LAKATOS-76										14.61		
506 LAKATOS-76										12.85		
507 LAKATOS-76						3.01				12.74		
508 LAKATOS-76				1.31						10.95		
509 LAKATOS-76				1.30		3.04				10.85		
510 LAKATOS-76										16.85		
511 LAKATOS-76										14.84		
512 LAKATOS-76						3.02				14.71		
513 LAKATOS-76				1.31						12.95		
514 LAKATOS-76				1.30		3.04				12.84		
515 LAKATOS-76						4.44				14.42		
516 LAKATOS-76						8.76				14.23		
517 LAKATOS-76						2.97				14.48		
518 LAKATOS-76						7.33				14.29		
519 PLUDINEC-78	0.00				0.00			0.00		22.76		0.00
520 PLUDINEC-78	6.99				0.00			0.86		19.79		2.55

THERMAL PROPERTIES

Reference	25 P2O5 mol%	26 PbO mol%	27 PdO mol%	28 Rb2O mol%	29 Rh2O3 mol%	30 RuO2 mol%	31 Sb2O3 mol%	32 SiO2 mol%	33 SrO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
469 LAKATOS-76								68.99				
470 LAKATOS-76								68.68				
471 LAKATOS-76								62.13				
472 LAKATOS-76								72.37				
473 LAKATOS-76								71.22				
474 LAKATOS-76								73.12				
475 LAKATOS-76								72.21				
476 LAKATOS-76								65.19				
477 LAKATOS-76								72.46				
478 LAKATOS-76								72.46				
479 LAKATOS-76								72.47				
480 LAKATOS-76								72.47				
481 LAKATOS-76								72.46				
482 LAKATOS-76								72.78				
483 LAKATOS-76								71.43				
484 LAKATOS-76								71.44				
485 LAKATOS-76								71.18				
486 LAKATOS-76								69.93				
487 LAKATOS-76		1.81						72.47				
488 LAKATOS-76		3.64						72.81				
489 LAKATOS-76								68.73				
490 LAKATOS-76								63.29				
491 LAKATOS-76								74.08				
492 LAKATOS-76								73.76				
493 LAKATOS-76								73.29				
494 LAKATOS-76								72.71				
495 LAKATOS-76								72.43				
496 LAKATOS-76								72.25				
497 LAKATOS-76								72.26				
498 LAKATOS-76								72.17				
499 LAKATOS-76								71.51				
500 LAKATOS-76								71.17				
501 LAKATOS-76								70.98				
502 LAKATOS-76								72.23				
503 LAKATOS-76								70.89				
504 LAKATOS-76								69.83				
505 LAKATOS-76								72.36				
506 LAKATOS-76								69.34				
507 LAKATOS-76								68.75				
508 LAKATOS-76								69.81				
509 LAKATOS-76								69.22				
510 LAKATOS-76								67.49				
511 LAKATOS-76								67.34				
512 LAKATOS-76								66.77				
513 LAKATOS-76								67.80				
514 LAKATOS-76								67.22				
515 LAKATOS-76								70.41				
516 LAKATOS-76								68.52				
517 LAKATOS-76								71.05				
518 LAKATOS-76								69.14				
519 PLUDINEC-78								54.79				7.85
520 PLUDINEC-78								47.63				6.82

THERMAL PROPERTIES

0 Reference	37 U3O8 mol%	38 UO2 mol%	39 UO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZnO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
169 LAKATOS-76							100.00			
170 LAKATOS-76							100.00			
171 LAKATOS-76							100.00			
172 LAKATOS-76							100.00			
173 LAKATOS-76							100.00			
174 LAKATOS-76							100.00			
175 LAKATOS-76							100.00			
176 LAKATOS-76							100.00			
177 LAKATOS-76							100.00			
178 LAKATOS-76							100.00			
179 LAKATOS-76							100.00			
180 LAKATOS-76							100.00			
181 LAKATOS-76							100.00			
182 LAKATOS-76							100.00			
183 LAKATOS-76					3.57		100.00			
184 LAKATOS-76					7.14		100.00			
195 LAKATOS-76							100.00			
196 LAKATOS-76							100.00			
197 LAKATOS-76							100.00			
198 LAKATOS-76							100.00			
199 LAKATOS-76							100.00			
200 LAKATOS-76							100.00			
501 LAKATOS-76							100.00			
502 LAKATOS-76							100.00			
503 LAKATOS-76							100.00			
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515 LAKATOS-76							100.00			
516 LAKATOS-76							100.00			
517 LAKATOS-76							100.00			
518 LAKATOS-76							100.00			
519 PLUMIER-78	0.00						100.00			
520 PLUMIER-78	0.31						100.00			

THERMAL PROPERTIES

Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
469 LAKATOS-76							
470 LAKATOS-76							
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472 LAKATOS-76							
473 LAKATOS-76							
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518 LAKATOS-76							
519 PLUDINEC-78							
520 PLUDINEC-78							

THERMAL PROPERTIES

U Reference	54 EC, 1100P ohm.cm-1	55 Tg(Trans. Temp)°C	56 Tg(Soft. Temp)°C	57 T30P °C	58 T100P °C	59 T(10)4P °C	60 T(10)5P °C	61 T(10)6P °C	62 T(10)7P °C
469 LAKATOS-76					1393.5	983.7		789.3	
470 LAKATOS-76					1336.4	988.4		766.2	
471 LAKATOS-76					1361.6	979.5		797.0	
472 LAKATOS-76					1480.1	1051.0		844.5	
473 LAKATOS-76					1453.8	1019.7		812.5	
474 LAKATOS-76					1467.3	1039.1		837.6	
475 LAKATOS-76					1444.7	1007.7		804.1	
476 LAKATOS-76					1332.7	955.4		773.6	
477 LAKATOS-76					1423.4	1010.8		818.5	
478 LAKATOS-76					1421.1	1008.0		815.6	
479 LAKATOS-76					1416.9	1002.9		809.9	
480 LAKATOS-76					1410.2	994.8		801.2	
481 LAKATOS-76					1404.4	990.9		798.1	
482 LAKATOS-76					1385.7	971.2		777.9	
483 LAKATOS-76					1420.0	1009.8		816.1	
484 LAKATOS-76					1436.7	1015.8		814.8	
485 LAKATOS-76					1373.5	982.2		803.4	
486 LAKATOS-76					1325.6	956.1		789.9	
487 LAKATOS-76					1405.9	991.2		799.8	
488 LAKATOS-76					1395.5	974.0		781.6	
489 LAKATOS-76					1282.7	933.9		778.7	
490 LAKATOS-76					1200.0	905.3		772.4	
491 LAKATOS-76					1464.5	1027.5		824.7	
492 LAKATOS-76					1456.7	1022.8		821.9	
493 LAKATOS-76					1436.4	1001.6		799.9	
494 LAKATOS-76					1419.9	991.8		793.9	
495 LAKATOS-76					1410.0	985.4		789.7	
496 LAKATOS-76					1397.5	967.7		769.2	
497 LAKATOS-76					1393.0	964.9		767.7	
498 LAKATOS-76					1390.1	963.7		767.6	
499 LAKATOS-76					1365.4	939.2		743.0	
500 LAKATOS-76					1353.5	931.9		738.5	
501 LAKATOS-76					1348.0	928.6		736.7	
502 LAKATOS-76					1409.8	984.0		787.3	
503 LAKATOS-76					1360.1	942.4		750.7	
504 LAKATOS-76					1320.5	908.6		720.8	
505 LAKATOS-76					1434.6	1011.3		815.3	
506 LAKATOS-76					1463.9	1043.5		848.8	
507 LAKATOS-76					1481.3	1056.0		854.4	
508 LAKATOS-76					1484.3	1058.6		859.4	
509 LAKATOS-76					1499.7	1069.9		864.3	
510 LAKATOS-76					1406.0	991.7		803.7	
511 LAKATOS-76					1410.4	1007.8		823.1	
512 LAKATOS-76					1431.7	1022.3		829.8	
513 LAKATOS-76					1435.1	1024.2		834.5	
514 LAKATOS-76					1422.1	1037.4		840.4	
515 LAKATOS-76					1437.0	1019.7		819.8	
516 LAKATOS-76					1435.7	1025.2		822.4	
517 LAKATOS-76					1436.6	1017.2		818.5	
518 LAKATOS-76					1436.4	1023.7		821.7	
519 PL001NEC-78					1018.0				
520 PL001NEC-78					1003.0				

THERMAL PROPERTIES

0 Reference	63 T(10)11P °C	64 T(10)12P °C	65 T(10)13P °C	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
469 LAKATOS-76							
470 LAKATOS-76							
471 LAKATOS-76							
472 LAKATOS-76							
473 LAKATOS-76							
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516 LAKATOS-76							
517 LAKATOS-76							
518 LAKATOS-76							
519 PLUDINEC-78							28.0
520 PLUDINEC-78							22.0

THERMAL PROPERTIES

0 Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
469 LAKATOS-76						
470 LAKATOS-76						
471 LAKATOS-76						
472 LAKATOS-76						
473 LAKATOS-76						
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518 LAKATOS-76						
519 PLUDINEC-78						
520 PLUDINEC-78						

THERMAL PROPERTIES

Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
469 LAKATOS-76						
470 LAKATOS-76						
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518 LAKATOS-76						
519 PLUDIER-78						
520 PLUDIER-78						

THERMAL PROPERTIES

0 Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th. Exp. lin. Coeff.
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469 LAKATOS-76				
470 LAKATOS-76				
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473 LAKATOS-76				
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517 LAKATOS-76				
518 LAKATOS-76				
519 PLDDINEC-78				
520 PLDDINEC-78				

0 Reference	1 Glass ID or Data Source	2 Al2O3 mol%	3 AlN mol%	4 B2O3 mol%	5 BaO mol%	6 BeO mol%	7 CaO mol%	8 CeO2 mol%	9 Cr2O3 mol%	10 Co2O mol%	11 CuO mol%	12 F mol%
521 PLDINEC-78	Frit 21	0.00		8.63			5.36					
522 PLDINEC-78	Frit 21, 25 HI	0.96		7.54			5.99					
523 PLDINEC-78	Frit 21, 30 HI	1.19		7.28			6.15					
524 PLDINEC-78	Frit 21, 10 HA	5.31		8.11			5.08					
525 PLDINEC-78	Frit 21, 15 HA	8.15		7.83			4.93					
526 PLDINEC-78	Frit 21, 20 HA	11.11		7.54			4.78					
527 PLDINEC-78	Frit 21, 25 HA	14.22		7.24			4.61					
528 PLDINEC-78	Frit 21, 35 HA	20.89		6.58			4.26					
529 PLDINEC-78	Frit 18, 25 HA	14.73		7.50			4.78					
530 PLDINEC-78	Frit 18, 25 SA	4.54		7.73			5.75					
531 PLDINEC-78	Frit 18, 35 SA	6.74		7.10			5.83					
532 PLDINEC-78	Frit 21, 25 SA	4.37		7.45			5.55					
533 PLDINEC-78	Frit 21, 30 SA	5.41		7.17			5.59					
534 PLDINEC-78	Frit 18, 25 SC	8.05		7.62			5.77					
535 PLDINEC-78	Frit 21, 20 SC	6.05		7.64			5.52					
536 PLDINEC-78	Frit 21, 25 SC	7.76		7.35			5.57					
537 PLDINEC-78	Frit 21, 30 SC	9.58		7.05			5.62					
538 SASEK-77	#1											
539 SASEK-77	#2											
540 SASEK-77	#3											
541 SASEK-77	#4											
542 SASEK-77	#5											
543 SASEK-77	#6											
544 SASEK-77	#7											
545 SASEK-77	#8											
546 SASEK-77	#9											
547 SASEK-77	#10											
548 SASEK-77	#11											
549 SASEK-77	#12											
550 SASEK-77	#13									33.33		
551 SASEK-77	#14									25.00		
552 SASEK-77	#15									20.00		
553 SCHTEHER-86	SF513F2	1.74		12.49	0.00		5.38	0.00	0.00			0.00
554 SCHTEHER-86	SF513L00A	2.02		11.70	0.03		5.04	0.13	0.12	0.01		1.72
555 SCHTEHER-86	SF513L011	2.13		11.39	0.03		4.91	0.18	0.17	0.02		2.39
556 SCHTEHER-86	SF513L014	2.24		11.08	0.04		4.77	0.23	0.22	0.02		3.06
557 SHELBLY-74	#1											
558 SHELBLY-74	#2											
559 SHELBLY-74	#3											
560 SHELBLY-74	#4											
561 SHELBLY-74	#5											
562 SHELBLY-74	#6											
563 SHELBLY-74	#7											
564 SHELBLY-74	#8											
565 SHELBLY-74	#9											
566 SHELBLY-74	#10											
567 SHELBLY-74	#11											
568 SHELBLY-74	#12											
569 SHELBLY-74	#13											
570 SHELBLY-74	#14											
571 SHELBLY-74	#15											
572 SHELBLY-74	#16											

THERMAL PROPERTIES

Reference	13 Fe2O3 mol%	14 Ga2O3 mol%	15 GaO2 mol%	16 K2O mol%	17 Li2O mol%	18 MgO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
521 PLUDINEC-78	0.00				8.04			0.00		17.94		0.00
522 PLUDINEC-78	6.73				7.03			0.83		15.68		2.46
523 PLUDINEC-78	8.35				6.79			1.02		15.13		3.05
524 PLUDINEC-78	0.24				7.56			0.35		16.85		0.08
525 PLUDINEC-78	0.36				7.30			0.54		16.28		0.12
526 PLUDINEC-78	0.49				7.03			0.74		15.67		0.16
527 PLUDINEC-78	0.63				6.75			0.95		15.04		0.20
528 PLUDINEC-78	0.93				6.14			1.39		13.68		0.30
529 PLUDINEC-78	0.65				0.00			0.98		18.95		0.21
530 PLUDINEC-78	4.88				0.00			2.41		19.52		1.20
531 PLUDINEC-78	7.25				0.00			3.58		17.95		1.78
532 PLUDINEC-78	8.71				6.94			2.33		15.48		1.16
533 PLUDINEC-78	5.82				6.68			2.88		14.89		1.43
534 PLUDINEC-78	3.50				0.00			2.10		19.27		0.54
535 PLUDINEC-78	2.63				7.12			1.57		15.87		0.41
536 PLUDINEC-78	3.38				6.85			2.02		15.28		0.53
537 PLUDINEC-78	4.16				6.57			2.49		14.66		0.65
538 SASEK-77					33.33							
539 SASEK-77					25.00							
540 SASEK-77					20.00							
541 SASEK-77										33.33		
542 SASEK-77										25.00		
543 SASEK-77										20.00		
544 SASEK-77				33.33								
545 SASEK-77				25.00								
546 SASEK-77				20.00								
547 SASEK-77												
548 SASEK-77												
549 SASEK-77												
550 SASEK-77												
551 SASEK-77												
552 SASEK-77												
553 SCHTEMER-H6	0.00				9.31	3.38		0.00	0.00	6.21	0.00	0.00
554 SCHTEMER-H6	0.46				8.71	3.16		0.22	0.08	8.11	0.07	0.25
555 SCHTEMER-H6	0.63				8.49	3.08		0.30	0.12	8.84	0.09	0.35
556 SCHTEMER-H6	0.81				8.25	2.99		0.39	0.15	9.58	0.12	0.45
557 SHELBY-74			100.00							0.00		
558 SHELBY-74			99.00							1.00		
559 SHELBY-74			98.00							2.00		
560 SHELBY-74			95.00							5.00		
561 SHELBY-74			92.00							8.00		
562 SHELBY-74			90.00							10.00		
563 SHELBY-74			88.00							12.00		
564 SHELBY-74			85.00							15.00		
565 SHELBY-74			82.50							17.50		
566 SHELBY-74			80.00							20.00		
567 SHELBY-74			75.00							25.00		
568 SHELBY-74			72.50							27.50		
569 SHELBY-74			70.00							30.00		
570 SHELBY-74			67.50							32.50		
571 SHELBY-74			65.00							35.00		
572 SHELBY-74			99.00	2.00								

[illegible]

THERMAL PROPERTIES

0 Reference	37 U3U8 mol%	38 UO2 mol%	39 MO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZnO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
521 PLODINEC-78	0.00						100.00			
522 PLODINEC-78	0.30						100.00			
523 PLODINEC-78	0.37						100.00			
524 PLODINEC-78	0.01						100.00			
525 PLODINEC-78	0.02						100.00			
526 PLODINEC-78	0.02						100.00			
527 PLODINEC-78	0.03						100.00			
528 PLODINEC-78	0.04						100.00			
529 PLODINEC-78	0.03						100.00			
530 PLODINEC-78	0.23						100.00			
531 PLODINEC-78	0.35						100.00			
532 PLODINEC-78	0.23						100.00			
533 PLODINEC-78	0.28						100.00			
534 PLODINEC-78	0.13						100.00			
535 PLODINEC-78	0.10						100.00			
536 PLODINEC-78	0.12						100.00			
537 PLODINEC-78	0.15						100.00			
538 SASFK-77							100.00			
539 SASFK-77							100.00			
540 SASFK-77							100.00			
541 SASFK-77							100.00			
542 SASFK-77							100.00			
543 SASFK-77							100.00			
544 SASFK-77							100.00			
545 SASFK-77							100.00			
546 SASFK-77							100.00			
547 SASFK-77							100.00			
548 SASFK-77							100.00			
549 SASFK-77							100.00			
550 SASFK-77							100.00			
551 SASFK-77							100.00			
552 SASFK-77							100.00			
553 SCHTEPER-86		0.00				0.00	100.00		9.90e-02	1.61e-01
554 SCHTEPER-86		0.02				0.18	100.00		1.00e-01	1.67e-01
555 SCHTEPER-86		0.02				0.25	100.00		1.22e-01	1.89e-01
556 SCHTEPER-86		0.03				0.32	100.00		1.25e-01	2.00e-01
557 SHELBY-74							100.00			
558 SHELBY-74							100.00			
559 SHELBY-74							100.00			
560 SHELBY-74							100.00			
561 SHELBY-74							100.00			
562 SHELBY-74							100.00			
563 SHELBY-74							100.00			
564 SHELBY-74							100.00			
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566 SHELBY-74							100.00			
567 SHELBY-74							100.00			
568 SHELBY-74							100.00			
569 SHELBY-74							100.00			
570 SHELBY-74							100.00			
571 SHELBY-74							100.00			
572 SHELBY-74							100.00			

THERMAL PROPERTIES

0 Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
521 PLUDINEC-78							
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538 SASEK-77							
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550 SASEK-77							
551 SASEK-77							
552 SASEK-77							
553 SCHIEBER-86		1.92e-01					
554 SCHIEBER-86		2.08e-01					
555 SCHIEBER-86		2.50e-01					
556 SCHIEBER-86		2.63e-01					
557 SHELBY-74							
558 SHELBY-74							
559 SHELBY-74							
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THERMAL PROPERTIES

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THERMAL PROPERTIES

Reference	63 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
521 PLDINEC-78						16.7	
522 PLDINEC-78						11.0	
523 PLDINEC-78						9.8	
524 PLDINEC-78						33.0	
525 PLDINEC-78						51.0	
526 PLDINEC-78						82.0	
527 PLDINEC-78						139.0	
528 PLDINEC-78						509.0	
529 PLDINEC-78						250.0	
530 PLDINEC-78						55.0	
531 PLDINEC-78						61.0	
532 PLDINEC-78						21.0	
533 PLDINEC-78						22.0	
534 PLDINEC-78						100.0	
535 PLDINEC-78						40.0	
536 PLDINEC-78						40.0	
537 PLDINEC-78						54.0	
538 SASEK-77					196.708872		72.444054
539 SASEK-77					436.516372		168.268470
540 SASEK-77					7516.238238		1702.169274
541 SASEK-77					448.745945		167.110118
542 SASEK-77					1327.396100		451.858802
543 SASEK-77					2937.653286		946.243146
544 SASEK-77					1312.201522		401.793352
545 SASEK-77					3280.956990		883.085486
546 SASEK-77					6382.642757		1832.326012
547 SASEK-77					2546.833403		711.218012
548 SASEK-77					7014.561661		1819.712368
549 SASEK-77							
550 SASEK-77							
551 SASEK-77							
552 SASEK-77							
553 SCHIEFER-86				330	120.00		80.00
554 SCHIEFER-86				230	80.00		53.00
555 SCHIEFER-86				202	70.00		50.00
556 SCHIEFER-86				150	60.00		40.00
557 SHELBY-74	572	527	487				
558 SHELBY-74	473	447	426				
559 SHELBY-74	466	445	425				
560 SHELBY-74	466	449	433				
561 SHELBY-74	501	486	471				
562 SHELBY-74	507	493	479				
563 SHELBY-74	533	522	512				
564 SHELBY-74	545	535	525				
565 SHELBY-74	542	533	524				
566 SHELBY-74	542	533	524				
567 SHELBY-74	513	502	492				
568 SHELBY-74	495	485	475				
569 SHELBY-74	475	464	453				
570 SHELBY-74	451	440	429				
571 SHELBY-74	430	419	407				
572 SHELBY-74	403	397	384				

THERMAL PROPERTIES

U Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
521 PLUDINEC-78						
522 PLUDINEC-78						
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535 PLUDINEC-78						
536 PLUDINEC-78						
537 PLUDINEC-78						
538 SASEK-77		33.573663		17.79		
539 SASEK-77		79.067630		31.55		
540 SASEK-77		532.106694		211.30		
541 SASEK-77		76.735923		30.55		
542 SASEK-77		190.984764		80.17		
543 SASEK-77		360.188278		173.00		
544 SASEK-77		158.488853		57.94		
545 SASEK-77		313.327651		129.70		
546 SASEK-77		654.634249		279.30		
547 SASEK-77		230.143505		88.11		
548 SASEK-77		619.439253		244.30		
549 SASEK-77				495.50		
550 SASEK-77				100.00		
551 SASEK-77				368.10		
552 SASEK-77				822.20		
553 SCHIEBER-86						
554 SCHIEBER-86						
555 SCHIEBER-86						
556 SCHIEBER-86						
557 SHELBY-74						
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THERMAL PROPERTIES

0 Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
521 PLODINEC-78						
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552 SASEK-77						
553 SCHIEVER-86						
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557 SHELBY-74						
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THERMAL PROPERTIES

0 Reference	82 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th.Exp. Lin.Coeff.	86
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521	PLODINEC-78				
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533	PLODINEC-78				
534	PLODINEC-78				
535	PLODINEC-78				
536	PLODINEC-78				
537	PLODINEC-78				
538	SASEK-77				
539	SASEK-77				
540	SASEK-77				
541	SASEK-77				
542	SASEK-77				
543	SASEK-77				
544	SASEK-77				
545	SASEK-77				
546	SASEK-77				
547	SASEK-77				
548	SASEK-77				
549	SASEK-77				
550	SASEK-77				
551	SASEK-77				
552	SASEK-77				
553	SCHIEPER-86				
554	SCHIEPER-86				
555	SCHIEPER-86				
556	SCHIEPER-86				
557	SHELBY-74				
558	SHELBY-74				
559	SHELBY-74				
560	SHELBY-74				
561	SHELBY-74				
562	SHELBY-74				
563	SHELBY-74				
564	SHELBY-74				
565	SHELBY-74				
566	SHELBY-74				
567	SHELBY-74				
568	SHELBY-74				
569	SHELBY-74				
570	SHELBY-74				
571	SHELBY-74				
572	SHELBY-74				

THEIRAL PROPERTIES

0 Reference	1 Glass ID or Data Source	2 Al2O3 mol%	3 AlN mol%	4 B2O3 mol%	5 BaO mol%	6 BaO mol%	7 CaO mol%	8 CeO2 mol%	9 Cr2O3 mol%	10 Cs2O mol%	11 CuO mol%	12 F mol%
573 SHELBY-74	#17											
574 SHELBY-74	#18											
575 SHELBY-74	#19											
576 SHELBY-74	#20											
577 SHELBY-74	#21											
578 SHELBY-74	#22											
579 SHELBY-74	#23											
580 SHELBY-74	#24											
581 SHELBY-74	#25											
582 SHELBY-74	#26											
583 SHELBY-74	#27											
584 SHELBY-74	#28											
585 SHELBY-74	#29											
586 SHELBY-74	#30											
587 SHELBY-74	#31											
588 SHELBY-74	#32											
589 URRAIP-84	#1	0.66	4.12				31.76					
590 URRAIP-84	#2	0.00	9.73				30.49					
591 URRAIP-84	#3	0.66	17.08				27.36					
592 VANUITERT-79				51.66								
593 VANUITERT-79				61.58								
594 VANUITERT-79				68.13								
595 VANUITERT-79				76.22								
596 VANUITERT-79				86.51								
597 VANUITERT-79												
598 VANUITERT-79				50.29								
599 VANUITERT-79												
600 WILEY-78	FRIT 1A	0.00		9.01			5.59					
601 WILEY-78	FRIT 1A, HA 25	14.73		7.50			4.78					
602 WILEY-78	FRIT 1A, HA 35	21.57		6.80			4.40					
603 WILEY-78	FRIT 1A, HA 45	29.08		6.03			3.99					
604 WILEY-78	FRIT 1A, HI 25	1.00		7.83			6.22					
605 WILEY-78	FRIT 1A, HI 35	1.49		7.25			6.53					
606 WILEY-78	FRIT 1A, HI 45	2.06		6.58			6.89					
607 WILEY-78	FRIT 1A, SA 25	4.54		7.73			5.75					
608 WILEY-78	FRIT 1A, SA 35	6.74		7.10			5.83					
609 WILEY-78	FRIT 1A, SA 45	9.23		6.40			5.92					
610 WILEY-78	FRIT 21	0.00		6.63			5.36					
611 WILEY-78	FRIT 21, HA 25	14.22		7.24			4.61					
612 WILEY-78	FRIT 21, HA 35	20.89		6.58			4.26					
613 WILEY-78	FRIT 21, HA 45	28.26		5.86			3.88					
614 WILEY-78	FRIT 21, HI 25	0.96		7.52			5.99					
615 WILEY-78	FRIT 21, HI 35	1.44		7.00			6.31					
616 WILEY-78	FRIT 21, HI 45	2.00		6.34			6.68					
617 WILEY-78	FRIT 21, I 35	0.00		7.18			4.45					
618 WILEY-78	FRIT 21, I 45	0.00		6.60			4.10					
619 WILEY-78	FRIT 21, SA 25	4.37		7.45			5.55					
620 WILEY-78	FRIT 21, SA 30	5.41		7.17			5.59					
621 WILEY-78	FRIT 21, SA 35	6.51		6.87			5.64					
622 WILEY-78	FRIT 21, SC 25	7.76		7.35			5.57					
623 WILEY-78	FRIT 21, SC 35	11.50		6.74			5.67					
624 WILEY-78	FRIT 21, SC 45	15.60		6.05			5.78					

THERMAL PROPERTIES

0 Reference	13 Fe2O3 mol%	14 Gd2O3 mol%	15 GeO2 mol%	16 K2O mol%	17 Li2O mol%	18 MgO mol%	19 Minor mol%	20 MnO2 mol%	21 MoO3 mol%	22 Na2O mol%	23 Nd2O3 mol%	24 NiO mol%
573 SHELBY-74			95.00	5.00								
574 SHELBY-74			90.00	10.00								
575 SHELBY-74			85.00	15.00								
576 SHELBY-74			82.50	17.50								
577 SHELBY-74			77.50	22.50								
578 SHELBY-74			75.00	25.00								
579 SHELBY-74			72.50	27.50								
580 SHELBY-74			70.00	30.00								
581 SHELBY-74			98.00									
582 SHELBY-74			95.00									
583 SHELBY-74			90.00									
584 SHELBY-74			80.00									
585 SHELBY-74			75.00									
586 SHELBY-74			95.00									
587 SHELBY-74			90.00									
588 SHELBY-74			75.00									
589 URBAIN-84												
590 URBAIN-84												
591 URBAIN-84												
592 VANUITERT-79												
593 VANUITERT-79												
594 VANUITERT-79												
595 VANUITERT-79												
596 VANUITERT-79												
597 VANUITERT-79												
598 VANUITERT-79												
599 VANUITERT-79												
600 WILEY-78	0.00				0.00			0.00		22.76		0.00
601 WILEY-78	0.65				0.00			0.98		18.95		0.21
602 WILEY-78	0.96				0.00			1.44		17.18		0.31
603 WILEY-78	1.29				0.00			1.94		15.24		0.41
604 WILEY-78	4.99				0.00			0.86		19.79		2.55
605 WILEY-78	10.45				0.00			1.28		18.32		3.82
606 WILEY-78	14.41				0.00			1.77		16.63		5.27
607 WILEY-78	4.88				0.00			2.41		19.52		1.20
608 WILEY-78	7.25				0.00			3.58		17.95		1.78
609 WILEY-78	7.23				0.00			4.91		16.18		2.44
610 WILEY-78	0.00				8.04			0.00		17.94		0.00
611 WILEY-78	0.63				6.75			0.95		15.04		0.20
612 WILEY-78	0.93				6.14			1.39		13.68		0.30
613 WILEY-78	1.25				5.46			1.88		12.18		0.40
614 WILEY-78	6.73				7.03			0.83		15.68		2.46
615 WILEY-78	10.09				6.53			1.24		14.55		3.69
616 WILEY-78	13.97				5.94			1.71		13.25		5.11
617 WILEY-78	16.85				6.69			0.00		14.91		0.00
618 WILEY-78	23.50				6.15			0.00		13.71		0.00
619 WILEY-78	4.71				6.94			2.33		15.48		1.16
620 WILEY-78	5.42				6.68			2.88		14.89		1.43
621 WILEY-78	7.01				6.40			3.46		14.27		1.72
622 WILEY-78	3.37				6.85			2.02		15.28		0.53
623 WILEY-78	5.00				6.28			2.99		14.00		0.78
624 WILEY-78	6.92				5.64			4.08		12.57		1.06

THERMAL PROPERTIES

0 Reference	25 PdOS mol%	26 PdO mol%	27 PdO mol%	28 Rb2O mol%	29 Rb2O3 mol%	30 RuO2 mol%	31 SO3 mol%	32 SiO2 mol%	33 SrO mol%	34 TeO2 mol%	35 ThO2 mol%	36 TiO2 mol%
573 SHELBY-74												
574 SHELBY-74												
575 SHELBY-74												
576 SHELBY-74												
577 SHELBY-74												
578 SHELBY-74												
579 SHELBY-74												
580 SHELBY-74												
581 SHELBY-74				2.00								
582 SHELBY-74				5.00								
583 SHELBY-74				10.00								
584 SHELBY-74				20.00								
585 SHELBY-74				25.00								
586 SHELBY-74												
587 SHELBY-74												
588 SHELBY-74												
589 ORRADIO-84								63.46				
590 ORRADIO-84								59.77				
591 ORRADIO-84								54.90				
592 VANUITERT-79	48.34											
593 VANUITERT-79	38.42											
594 VANUITERT-79	31.87											
595 VANUITERT-79	23.78											
596 VANUITERT-79	13.49											
597 VANUITERT-79	16.54											
598 VANUITERT-79	16.81									49.93		
599 VANUITERT-79	16.54									32.91		
600 WILEY-78								54.79				7.85
601 WILEY-78								45.62				6.54
602 WILEY-78								41.37				5.93
603 WILEY-78								36.69				5.26
604 WILEY-78								47.63				6.82
605 WILEY-78								44.09				6.32
606 WILEY-78								40.03				5.73
607 WILEY-78								47.00				6.73
608 WILEY-78								43.21				6.19
609 WILEY-78								38.94				5.58
610 WILEY-78								52.51				7.52
611 WILEY-78								44.03				6.31
612 WILEY-78								40.05				5.74
613 WILEY-78								35.66				5.11
614 WILEY-78								45.90				6.58
615 WILEY-78								42.60				5.16
616 WILEY-78								38.80				5.56
617 WILEY-78								43.66				6.26
618 WILEY-78								40.15				5.75
619 WILEY-78								45.31				6.49
620 WILEY-78								43.60				6.25
621 WILEY-78								41.78				5.99
622 WILEY-78								44.73				6.41
623 WILEY-78								40.79				5.87
624 WILEY-78								36.40				5.27

THERMAL PROPERTIES

0 Reference	37 U3O8 mol%	38 UO2 mol%	39 MO3 mol%	40 ZnF2 mol%	41 ZnO mol%	42 ZrO2 mol%	43 Total mol%	44 EC, 900 C ohm.cm-1	45 EC, 1000 C ohm.cm-1	46 EC, 1100 C ohm.cm-1
573 SHELBY-74							100.00			
574 SHELBY-74							100.00			
575 SHELBY-74							100.00			
576 SHELBY-74							100.00			
577 SHELBY-74							100.00			
578 SHELBY-74							100.00			
579 SHELBY-74							100.00			
580 SHELBY-74							100.00			
581 SHELBY-74							100.00			
582 SHELBY-74							100.00			
583 SHELBY-74							100.00			
584 SHELBY-74							100.00			
585 SHELBY-74							100.00			
586 SHELBY-74							100.00			
587 SHELBY-74							100.00			
588 SHELBY-74							100.00			
589 SHELBY-74							100.00			
590 URBAIN-84							100.00			
591 URBAIN-84							100.00			
592 VANUITERT-79							100.00			
593 VANUITERT-79							100.00			
594 VANUITERT-79							100.00			
595 VANUITERT-79							100.00			
596 VANUITERT-79							100.00			
597 VANUITERT-79			33.53				100.00			
598 VANUITERT-79							100.00			
599 VANUITERT-79				17.08			100.00			
600 WILEY-74	0.00						100.00	9.09e-02	1.25e-01	1.67e-01
601 WILEY-74	0.03						100.00	5.88e-02	9.52e-02	1.39e-01
602 WILEY-74	0.05						100.00	5.00e-02	8.33e-02	1.22e-01
603 WILEY-74	0.06						100.00	3.70e-03	2.00e-02	4.00e-02
604 WILEY-74	0.31						100.00	4.88e-02	6.67e-02	8.33e-02
605 WILEY-74	0.46						100.00	4.88e-02	6.67e-02	7.69e-02
606 WILEY-74	0.63						100.00	5.26e-02	8.33e-02	1.00e-01
607 WILEY-74	0.23						100.00	6.25e-02	1.00e-01	1.43e-01
608 WILEY-74	0.35						100.00	4.55e-02	5.88e-02	7.69e-02
609 WILEY-74	0.08						100.00	3.13e-02	3.70e-02	4.55e-02
610 WILEY-74	0.00						100.00	1.00e-01	1.41e-01	1.54e-01
611 WILEY-74	0.03						100.00	4.88e-02	9.09e-02	1.11e-01
612 WILEY-74	0.04						100.00	4.88e-02	9.09e-02	1.11e-01
613 WILEY-74	0.06						100.00	2.50e-02	5.88e-02	7.52e-02
614 WILEY-74	0.30						100.00	5.00e-02	9.52e-02	1.32e-01
615 WILEY-74	0.09						100.00	6.25e-02	1.18e-01	1.43e-01
616 WILEY-74	0.61						100.00	8.33e-02	1.18e-01	1.43e-01
617 WILEY-74	0.00						100.00	9.52e-02	1.25e-01	1.43e-01
618 WILEY-74	0.00						100.00	9.35e-02	1.00e-01	1.43e-01
619 WILEY-74	0.23						100.00			
620 WILEY-74	0.26						100.00	7.69e-02	1.10e-01	1.43e-01
621 WILEY-74	0.50						100.00	5.00e-02	9.09e-02	1.25e-01
622 WILEY-74	0.17						100.00	8.93e-02	9.80e-02	1.43e-01
623 WILEY-74	0.10						100.00			
624 WILEY-74	0.25						100.00	9.09e-02	9.52e-02	1.11e-01

THERMAL PROPERTIES

0 Reference	47 EC, 1150 C ohm.cm-1	48 EC, 1200 C ohm.cm-1	49 EC, 1300 C ohm.cm-1	50 EC, 1400 C ohm.cm-1	51 EC, 1500 C ohm.cm-1	52 EC, 1700 C ohm.cm-1	53 EC, 1900 C ohm.cm-1
573 SHELBY-74							
574 SHELBY-74							
575 SHELBY-74							
576 SHELBY-74							
577 SHELBY-74							
578 SHELBY-74							
579 SHELBY-74							
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581 SHELBY-74							
582 SHELBY-74							
583 SHELBY-74							
584 SHELBY-74							
585 SHELBY-74							
586 SHELBY-74							
587 SHELBY-74							
588 SHELBY-74							
589 URBAIN-84							
590 URBAIN-84							
591 URBAIN-84							
592 VANUITERT-79							
593 VANUITERT-79							
594 VANUITERT-79							
595 VANUITERT-79							
596 VANUITERT-79							
597 VANUITERT-79							
598 VANUITERT-79							
599 VANUITERT-79							
600 WILEY-78	1.79e-01	1.92e-01					
601 WILEY-78	1.52e-01	1.67e-01					
602 WILEY-78	1.33e-01	1.43e-01					
603 WILEY-78	5.56e-02	6.67e-02					
604 WILEY-78	8.33e-02	9.09e-02					
605 WILEY-78	7.69e-02	7.69e-02					
606 WILEY-78	1.10e-01	1.18e-01					
607 WILEY-78	1.54e-01	1.67e-01					
608 WILEY-78	8.33e-02	7.14e-02					
609 WILEY-78	4.55e-02	4.76e-02					
610 WILEY-78	1.57e-01						
611 WILEY-78	1.25e-01						
612 WILEY-78	1.25e-01						
613 WILEY-78	1.05e-01						
614 WILEY-78	1.54e-01						
615 WILEY-78	1.50e-01						
616 WILEY-78	1.61e-01						
617 WILEY-78	1.54e-01						
618 WILEY-78	1.54e-01						
619 WILEY-78							
620 WILEY-78	1.54e-01						
621 WILEY-78	1.50e-01						
622 WILEY-78	1.54e-01	1.67e-01					
623 WILEY-78							
624 WILEY-78	1.30e-01	1.17e-01					

THERMAL PROPERTIES

0	Reference	57 EC _a T(10)P phm,cmm=1	58 Ts(Soft. Temp)oC	59 T(10)SP oC	60 T(10)6P oC	61 T(10)7P oC
573	SHELBY-74					
574	SHELBY-74					
575	SHELBY-74					
576	SHELBY-74					
577	SHELBY-74					
578	SHELBY-74					
579	SHELBY-74					
580	SHELBY-74					
581	SHELBY-74					
582	SHELBY-74					
583	SHELBY-74					
584	SHELBY-74					
585	SHELBY-74					
586	SHELBY-74					
587	SHELBY-74					
588	SHELBY-74					
589	URBAIN-84					
590	URBAIN-84					
591	URBAIN-84					
592	VANUITERT-79	553				
593	VANUITERT-79	623				
594	VANUITERT-79	633				
595	VANUITERT-79	703				
596	VANUITERT-79	773				
597	VANUITERT-79	673				
598	VANUITERT-79	678				
599	VANUITERT-79	553				
600	WILEY-78					
601	WILEY-78					
602	WILEY-78					
603	WILEY-78					
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617	WILEY-78					
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619	WILEY-78					
620	WILEY-78					
621	WILEY-78					
622	WILEY-78					
623	WILEY-78					
624	WILEY-78					

THERMAL PROPERTIES

0 Reference	63 T(10)11P oC	64 T(10)12P oC	65 T(10)13P oC	66 Visc, 1000 C Poise	67 Visc, 1100 C Poise	68 Visc, 1150 C Poise	69 Visc, 1200 C Poise
573 SHELBY-74	482	463	445				
574 SHELBY-74	517	501	486				
575 SHELBY-74	543	531	520				
576 SHELBY-74	548	537	526				
577 SHELBY-74	538	528	518				
579 SHELBY-74	530	513	496				
579 SHELBY-74	499	484	471				
580 SHELBY-74	469	455	441				
581 SHELBY-74	445	460	436				
582 SHELBY-74	484	462	441				
583 SHELBY-74	518	502	486				
584 SHELBY-74	553	543	534				
585 SHELBY-74	515	504	493				
586 SHELBY-74	487	467	448				
587 SHELBY-74	518	502	485				
588 SHELBY-74	489	468	448				
589 ORBAIN-84							
590 ORBAIN-84							
591 ORBAIN-84							
592 VANHITERT-79							
593 VANHITERT-79							
594 VANHITERT-79							
595 VANHITERT-79							
596 VANHITERT-79							
597 VANHITERT-79							
598 VANHITERT-79							
599 VANHITERT-79							
600 WILEY-78							
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620 WILEY-78							
621 WILEY-78							
622 WILEY-78							
623 WILEY-78							
624 WILEY-78							

THERMAL PROPERTIES

Reference	70 Visc, 1250 C Poise	71 Visc, 1300 C Poise	72 Visc, 1400 C Poise	73 Other Visc. Poise	74 Other Visc. Poise	75 Other Visc. Poise
573 SHELBY-74						
574 SHELBY-74						
575 SHELBY-74						
576 SHELBY-74						
577 SHELBY-74						
578 SHELBY-74						
579 SHELBY-74						
580 SHELBY-74						
581 SHELBY-74						
582 SHELBY-74						
583 SHELBY-74						
584 SHELBY-74						
585 SHELBY-74						
586 SHELBY-74						
587 SHELBY-74						
588 SHELBY-74						
589 URRAIN-84				At 1360 C, 210	At 1550 C, 39.1	At 1610 C, 25.9
590 URRAIN-84				At 1258 C, 1650	At 1317 C, 1163	At 1323 C, 1075
591 URRAIN-84				At 1297 C, 1734	At 1360 C, 822	At 1397 C, 496
592 VANUITERT-79						
593 VANUITERT-79						
594 VANUITERT-79						
595 VANUITERT-79						
596 VANUITERT-79						
597 VANUITERT-79						
598 VANUITERT-79						
599 VANUITERT-79						
600 WILEY-78						
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617 WILEY-78						
618 WILEY-78						
619 WILEY-78						
620 WILEY-78						
621 WILEY-78						
622 WILEY-78						
623 WILEY-78						
624 WILEY-78						

THERMAL PROPERTIES

0 Reference	76 Other Visc. Poise	77 Other Visc. Poise	78 Other Visc. Poise	79 Other Visc. Poise	80 Other Visc. Poise	81 Other Visc. Poise
573 SHELBY-74						
574 SHELBY-74						
575 SHELBY-74						
576 SHELBY-74						
577 SHELBY-74						
578 SHELBY-74						
579 SHELBY-74						
580 SHELBY-74						
581 SHELBY-74						
582 SHELBY-74						
583 SHELBY-74						
584 SHELBY-74						
585 SHELBY-74						
586 SHELBY-74						
587 SHELBY-74						
588 SHELBY-74						
589 URRAID-74	At 1626 C, 24.5	At 1629 C, 23.7	At 1630 C, 23.7	At 1630 C, 23.2	At 1648 C, 15.5	
590 URRAID-74	At 1382 C, 439	At 1471 C, 161	At 1512 C, 137	At 1522 C, 133	At 1526 C, 122	At 1532 C, 118
591 URRAID-74	At 1464 C, 268	At 1466 C, 233	At 507 C, 152	At 1543 C, 111	At 1544 C, 109	At 1625 C, 73.3
592 VANUITERT-79						
593 VANUITERT-79						
594 VANUITERT-79						
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598 VANUITERT-79						
599 VANUITERT-79						
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623 WILEY-74						
624 WILEY-74						

THERMAL PROPERTIES

0 Reference	12 Other Visc. Poise	83 Other Visc. Poise	84 Other Visc. Poise	85 Th.Exp. Lin.Coeff.
573 SHELBY-74				
574 SHELBY-74				
575 SHELBY-74				
576 SHELBY-74				
577 SHELBY-74				
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584 SHELBY-74				
585 SHELBY-74				
586 SHELBY-74				
587 SHELBY-74				
588 SHELBY-74				
589 URBAN-84				
590 URBAN-84	At 1556 C, 106	At 1635 C, 67.6	At 1558 C, 97	
591 URBAN-84	At 1635 C, 67.6			
592 VANUITERT-79				3.98 Van Uitert
593 VANUITERT-79				4.81 Th.Exp.Coeff.
594 VANUITERT-79				4.45 are X(10)6
595 VANUITERT-79				4.89
596 VANUITERT-79				4.15
597 VANUITERT-79				127.00
598 VANUITERT-79				102.00
599 VANUITERT-79				173.00
600 WILEY-78				
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APPENDIX C

THE EFFECTS OF COMPOSITION ON GLASS DISSOLUTION RATES:
THE APPLICATION OF FOUR MODELS TO A DATA BASE

THE EFFECTS OF COMPOSITION ON
GLASS DISSOLUTION RATES:
THE APPLICATION OF FOUR MODELS
TO A DATA BASE

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ABSTRACT

Four models have been applied to a data base to relate glass dissolution in distilled water to composition. The data base is used to compare the predictions obtained from the models in fitting actual data. The usefulness of the data base in formulating a model is also demonstrated.

Two related models in which the composite or pH-adjusted free energy of hydration of the glass is the correlating parameter are compared with experimental data. In a structural model, the nonbridging oxygen content of the glasses is used to correlate glass dissolution rate to composition. In a model formulated for this report, the cation valence and the oxygen content of the glass are compared with observed dissolution rates.

The models were applied to the 28-day normalized silica release at 90°C for over 285 glass compositions with surface area to volume ratios of 10 m^{-1} (Materials Characterization Center MCC-1 glass durability test using distilled water). These glasses included the nonradioactive analogs of WV205 and SRL-165, as well as SRL-131, PNL 76-68, and a European glass, UK209.

Predicted glass dissolution rates show similar fits to the data for all four models. The predictions of the models were also plotted for two subsets of the glasses: waste glasses and Savannah River Laboratory glasses. The model predictions fit the data for these groups much better than they fit the data for the entire set of glasses.

SUMMARY

The Materials Characterization Center at Pacific Northwest Laboratory^(a) has compiled a data base of 285 glass compositions and durability leach test results. Four models that relate glass durability to a priori calculated values have been applied to this data base in order to evaluate the fits of the predictions from the models to a wide range of data.

Three of the glass models have been described previously: one calculates hydration energies, one calculates pH-adjusted hydration energies, and one structural model calculates the number of nonbridging oxygens (NBO) in the glass structure. These models have been applied to a data base of 285 glass compositions to evaluate relative accuracy. A "valence-oxygen model," a variation of the NBO model, was formulated and also applied to the data base.

All four models showed a comparable degree of precision when applied to the full data base using a linear logarithmic relationship [$\ln(r) = A + BX$, where r is the normalized 28-day silica release rate, A and B are unknown constants, and X is the appropriate model parameter]. The fit of each of the models improved as the data were restricted to waste glasses and even more when only Savannah River Laboratory glass data were considered (Figure A). This implies that these models will better predict durability behavior when applied to glasses with similar compositions or, possibly, glasses tested in the same laboratory.

Completion of the data base will help provide the data to demonstrate the composition/durability relationships needed to develop durable waste glasses.

(a) Operated for the U.S. Department of Energy by Battelle Memorial Institute under contract DE-AC06-76RL0 1830.

FIGURE A. The Linear Logarithmic Fit of the Four Models Improved as Related Glass Compositions Were Selected from the Data Base

ACKNOWLEDGMENTS

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INTRODUCTION

The purpose of this study on glass durability and composition is to compare the results of a published free energy model with those of a related structural model, the nonbridging oxygen (NBO) model, and those of a simple empirical (valence-oxygen) model. Correlations among the composition-based models indicate that these models can relate the durability of waste glasses to that of geologic and man-made glasses. This connection can aid in determining the long-term durability of waste glass, and independent models can serve as valuable checks on one another. This comparison of models is based on data from 28 day, 90°C deionized water tests (MCC-1). Other tests using longer times, different conditions or concentrated waters may be more appropriate for some repository simulations.

The conclusions of the study are presented, followed by descriptions of the four models and results of their predictions. Procedures for calculations and a list of glass composition data and model parameters are contained in the appendices. This report describes the application of four models to over 285 glass compositions. This data base is being expanded to compile the majority of glass durability data at a single location.

The purpose of the glass durability models is to establish durabilities for glasses as a function of glass composition. Through these composition/durability relationships, the user will be able to relate the durability of a particular glass to that of other glasses and, in so doing, confirm or deny that the behavior of the glass is normal when compared with other glasses of similar composition. This report describes the comparative evaluation of four models or relationships using a data base of glass durabilities and compositions.

CONCLUSIONS

The nonbridging oxygen (NBO) model, the empirical valence-oxygen model, the free energy of hydration model, and the pH-adjusted free energy model offer similar accuracies in modeling 28-day leaching data from the MCC-1 static test. The NBO and valence-oxygen models are simple structural models that do not include temperature and solution effects that can be included in the free energy models. However, the valence-oxygen model assumes the formation of arbitrarily defined "stable" and "unstable" bonds, and the NBO structural model has predictive discrepancies with the free energy models for individual components. Unlike the structural models, the calculations for the free energy models require that enthalpy and free energy data be gathered, glass constituents and hydration reactions be assumed, and pH contributions be identified.

For groups of similar glasses, such as the Savannah River Laboratory (SRL) glasses, the experimental uncertainty of the glass dissolution rates appears to be close to the standard deviation for all four models, i.e., the model results fit these data very well. This strongly implies that these models will better predict durability behavior when applied to (limited subsets of data from) related glass compositions. Although all the models show correlation with glass dissolution rates, each model would need further improvement before it alone could be used to predict dissolution rate differences for all glasses in the data base.

As the data base is expanded, comparisons between models will include additional breadth, and model development and refinement can be facilitated.

DISCUSSION

KINETICS OF GLASS DISSOLUTION

Three reactions are considered to dominate the dissolution of silicate glasses in an aqueous environment (Paul 1977). The three reactions involved are:

1. Water molecules can attack alkali-oxygen bonds

where R^+ is an alkali metal cation.

2. A hydroxyl ion from solution can attack a siloxane bond in the glass

which produces a nonbridging oxygen.

3. The nonbridging oxygen generated in reaction (2) can combine with a water molecule

to generate another hydroxyl ion.

It was shown by Grambow (1985) that if a reaction scheme similar to this is assumed, the rate of the multicomponent matrix dissolution (r_m) in a dilute solution is given by

$$\ln(r_m) = A - \Delta G_{\text{hyd}}/RT \quad (1)$$

where ΔG_{hyd} = the free energy of hydration for the glass,

R = the gas constant,

T = the desolute temperature, and

A = a constant that varies with temperature.

Thus, the kinetics of glass dissolution as expressed by Grambow are tied to the thermodynamic stability of the glass.

FREE ENERGY MODEL

Free Energy of Hydration Calculations for Glass Dissolution Prediction

In order to calculate the change in free energy for a glass, it is assumed that the free energy of hydration is given by

$$G_{\text{hyd}} = RT \ln Q + \Delta G^{\circ}_{\text{hyd}} \quad (2)$$

where $RT \ln Q$ = the excess free energy of hydration

Q ($Q = \prod_i a_i^{v_i}$)^(a) = the ratio of activity of the products to the reactants,

a_i = the activity of a product or reactant,

v_i = the associated stoichiometric coefficient, and

$\Delta G^{\circ}_{\text{hyd}}$ = the standard free energy of hydration that can be calculated from tabulated data (Brewer and Pitzer 1961).

The solid phase is then assumed to be an ideal solution of n constituents that behave independently of each other in terms of their reactions with water. If each constituent has a mole fraction x_i , then

$$\Delta G_{\text{hyd}} = \sum x_i (\Delta G^{\circ}_{i \text{ hyd}} + RT \ln Q) \text{ for } i=1 \text{ to } n \quad (3)$$

where $\Delta G^{\circ}_{i \text{ hyd}}$ and Q_i are the standard free energy of hydration and activity ratios for component i (Reimus et al. 1986).

(a) $\prod_i$ signifies the product for all values of i .

For glasses in distilled water, when $RT \ln Q$ is neglected, Equation (3) has been used to show that the free energy of hydration provides a general trend between free energy changes and MCC-1 28-day normalized release values, and ultimately the glass dissolution rate (Plodinec, Jantzen, and Wicks 1984; Jantzen and Plodinec 1984; Jantzen 1986; Reimus et al. 1986). At higher pH values, free energy terms have been pH adjusted and shown to improve the fit of the free energy model (Jantzen 1986).

The procedure used to calculate the free energies of hydration for this report is located in Appendix A, along with a comparison of the calculation procedure used by Newton and Paul (1980) and Jantzen and Plodinec (1984).

Uncertainties of the Free Energy Model

The free energy model is useful for examining the durability of waste glasses although there are the following theoretical uncertainties:

- Assumptions about the identity of the glass constituents, their independent and ideal behavior in a glass, and the hydration reactions (Table 1) are reasonable, but they are difficult to confirm.
- Thermodynamic data at 90°C is not always available for calculation of free energies at the same temperature as the experiments (Atkins 1982). As a result, free energies calculated to 25°C are used as the closest approximation.
- Relating thermodynamic values (equilibrium based in dilute solutions) to short-term 28-day experimental data (kinetics impacted in nondilute solutions) is uncertain.
- The pH adjustment of the hydration energy in laboratory tests using unbuffered deionized water may differ from repository groundwater with some degree of natural buffering.
- Should the hydration energy calculations be normalized to the moles of constituents or to moles of glass raw materials? This question is discussed in Appendix A. The absolute values may differ, but the trends are the same.

TABLE 1. Free Energies of Hydration Glass Constituents,
and Corresponding Oxides at 25°C^(a)

Oxide	Glass Constituent	Aqueous Reaction Products		Free Energy of Hydration, kcal/mole
Al ₂ O ₃	Al ₂ O ₃	AlO(OH)		3.04
B ₂ O ₃	B ₂ O ₃	H ₃ BO ₃		-9.93
BaO	BaSiO ₃	Ba ²⁺	H ₂ SiO ₃	-30.57
CaO	CaSiO ₃	Ca ²⁺	H ₂ SiO ₃	-16.116
Cr ₂ O ₃	Cr ₂ O ₃	Cr(OH) ₃		37.36
Cs ₂ O	Cs ₂ SiO ₃	Cs ⁺	H ₂ SiO ₃	-46.82
FeO	FeSiO ₃	Fe ²⁺	H ₂ SiO ₃	-14.609
Fe ₂ O ₃	Fe ₂ O ₃	Fe(OH) ₃		15.5
K ₂ O	K ₂ SiO ₃	K ⁺	H ₂ SiO ₃	-41.735
Li ₂ O	Li ₂ SiO ₃	Li ⁺	H ₂ SiO ₃	-22.74
MgO	MgSiO ₃	Mg ²⁺	H ₂ SiO ₃	-13.888
MnO	MnSiO ₃	Mn ²⁺	H ₂ SiO ₃	-14.871
Na ₂ O	Na ₂ SiO ₃	Na ⁺	H ₂ SiO ₃	-28.815
Nd ₂ O ₃	Nd ₂ O ₃	Nd(OH) ₃		-28.32
NiO	NiSiO ₃	Ni ²⁺	H ₂ SiO ₃	-14.347
P ₂ O ₅	P ₂ O ₅	H ₃ PO ₄		-52.62
PbO	PbSiO ₃	Pb ²⁺	H ₂ SiO ₃	-8.81
Sb ₂ O ₃	Sb ₂ O ₃	N/A		N/A
SiO ₂	SiO ₂	H ₂ SiO ₃		5.59
SrO	SrSiO ₃	Sr ²⁺	H ₂ SiO ₃	-24.4
ThO ₂	ThO ₂	Th ⁴⁺		-2.533
TiO ₂	TiO ₂	TiO(OH) ₂		15.99
UO ₂	UO ₂	UO ₂ (OH)2H ₂ O		-6.8
ZrO ₂	ZrSiO ₄	ZrO(OH) ₂	H ₂ SiO ₃	45.1

(a) The data in this table were obtained from Plodinec, Jantzen,
and Wicks (1984)

NONBRIDGING OXYGEN MODEL

A structural model that is empirically related to the free energy model is the NBO model. It has been shown that the nonbridging oxygen fraction is a good measure of the free energy of hydration and, thus, the normalized silica release (Jantzen and Plodinec 1984). For the purposes of this paper, the NBO structural representation will be referred to as a model, and it will be compared to durability data to see how well it fits empirically.

Description of the Nonbridging Oxygen Model

The proportion of NBO gives an estimate of the degree of crosslinking in the glass (Jantzen and Plodinec 1984), and glass scientists such as Stevels (1948) have related the portion of NBO in the glass to the glass durability as early as 1948. More recently, Jantzen and Plodinec compared a version of the NBO model with the 28-day normalized silica release and showed that a clear correlation exists between NBO and the glass durability. The following formula was used to calculate NBO:

$$\text{NBO} = [2(\text{R}_2\text{O} + \text{RO}) + 6(\text{R}_2\text{O}_3) - 2(\text{Al}_2\text{O}_3 + \text{Fe}_2\text{O}_3) + 4(\text{RO}_2)] / \text{oxide sum} \quad (4)$$

(SiO_2 and B_2O_3 are not included in the calculations.)

The formula assumes that each mole of mono- and divalent oxide components contributes two moles of NBO atoms, and every mole of Al_2O_3 or Fe_2O_3 oxide creates two bridging oxygens. Other trivalent cations are assumed to create three NBO, but tetravalent cations such as zirconium are assumed to create four NBO. A more detailed discussion of the NBO model is beyond the scope of this text but can be found in Jantzen and Plodinec (1984).

A Comparison of the Nonbridging Oxygen and Free Energy Models

Because the NBO model does not assume any glass constituents or hydration reactions, it bypasses many of the assumptions of the free energy model. However, this structural model as applied to durability concerns shows some differences from the free energy model. First, unlike the free energy durability model, the NBO structural model "predicts" that the addition of a mole of R_2O has the same effect on glass durability as the addition of a mole of RO . Also,

tetravalent cations such as zirconium are assumed to increase the NBO concentration and thus decrease the glass durability, contrary to the predictions of the free energy model. Finally, Al_2O_3 and Fe_2O_3 are assumed to increase the durability of glasses to a much greater extent than the free energy model predicts. Despite these specific differences and the application of this structural model to durability processes, the NBO model fits the data as well as the others examined here.

VALENCE-OXYGEN MODEL

To avoid the discrepancies between the free energy of hydration and NBO models, a simple glass dissolution/composition model was developed. This step demonstrates the use of the data base as an aid in model development. The model that was developed is called the valence-oxygen model.

Description of the Valence-Oxygen Model

The valence-oxygen model is based upon the assumption that the relative stability that each cation contributes to a glass is dependent only upon its valence. It was observed by Jantzen and Plodinec (1984) that the ΔG_{hyd} of an oxide is related to the valence of the corresponding cation.

First, to describe the model, some terms are defined. Two terms that are essential to the model are the concepts of "stable" and "unstable" cation/oxygen bonds. It is assumed that any cation with a valence of one will form a single "unstable" cation/oxygen bond. Next, any cation with a valence of X ($X > 1$) will form X "stable" cation/oxygen bonds. (These concepts were arbitrarily defined.) To normalize the number of stable and unstable bonds, the moles of each bond type per mole of glass are divided by the total number of oxygens per mole of glass. In this way, the normalized bond type is not dependent upon the constituents that are chosen to represent each glass. The valence parameter, P , is a term that will be used to calculate relative stabilities of glasses. The definition of this parameter is based on the number of stable and unstable cation/oxygen bonds.

$$p = \frac{(\# \text{ of unstable bonds} + \# \text{ of oxygens for unstable oxides}) - (\# \text{ of stable bonds} - \# \text{ of oxygen atoms for stable oxides})}{\# \text{ of oxygen atoms}} \quad (5)$$

If we let $A = 3\sum(x_{R_2O})$ for all oxides of the form R_2O (This value is the number of moles of unstable cation/oxygen bonds per mole R_2O plus the moles of oxygen per mole R_2O .);

$B = \sum m(x_{R_jO_m})$ for all oxides in which $2m/j > 1$ (B_2O_3 is excluded from the calculation of B.) (B is the number of moles of stable cation/oxygen bonds per mole oxide minus the number of moles of oxygen atoms per mole of oxide.); and

$C = \sum k(x_{R_iO_k})$ for all oxides except B_2O_3 (This is the total moles of oxygen atoms per mole of glass.)

then

$$p = \frac{A - B}{C} \quad (6)$$

A more detailed description of this equation is given in Appendix B.

Because B_2O_3 has high-strength covalent cation/oxygen bonds (Jantzen and Plodinec 1984), it is assumed that it remains in its oxide form and acts independently of the silica/oxygen/cation matrix. For this reason, B_2O_3 is not considered when calculating the stable bond number or the total oxygen content of the glass.

Limitations of the Valence-Oxygen Model

Like the free energy of hydration and NBO models, the valence-oxygen model has many limitations. Unlike the free energy model, the valence-oxygen model does not predict differences that are caused by either temperature variations or variations in aqueous solution compositions. Thus, the valence-oxygen model cannot provide accurate dissolution rates for highly saturated aqueous environments such as repository brines. Also, the model does not predict differences that arise because of variations in similar species. For example, if Na_2O is

replaced by Li_2O , the valence-oxygen model would predict no difference in the dissolution rates, although the free energy model would (Plodinec, Jantzen and Wicks 1984; Jantzen and Plodinec 1984; Jantzen 1986). These differences could possibly be related to the cation size or cation/oxygen bond strengths (Jantzen and Plodinec 1984). A model which includes the ionic radii or bond strengths would likely improve the predictive power of the valence-oxygen model.

DATA BASE RESULTS

Each of the four models was applied to the 28-day dissolution rates of 285 glasses. The models are assumed to follow the logarithmic-linear form $\ln(r) = A + BX$, where r is the normalized 28-day silica release rate, A and B are unknown constants, and X is the appropriate model parameter. This linear form expresses the theoretical relationships for the free energy models although curves may provide closer empirical fits. The same form has also been fit to the NBD and valence-oxygen models to maintain consistency in the analysis of the results. Standard deviations from the best fit lines were calculated for the complete set of glasses, the waste glass subset, and the SRL glass subset. The entire database set is reproduced in Appendix C.

RESULTS OF THE FREE ENERGY OF HYDRATION MODELS

The natural log of the 28-day normalized silica release at 90°C with surface area/volume ratios of 10 m^{-1} was plotted against the standard and the pH-corrected free energies of hydration in Figures 1 and 2, respectively. The data included 285 glasses that consist of many waste glasses, natural glasses, and man-made glasses. The best fit straight lines are shown in Figures 1 and 2. The standard deviations of the natural log of the 28-day normalized silica release from the best fit lines are 1.02 and 0.92 for the two respective figures, and the maximum deviations from the lines are 3.36 and 2.80, respectively. These standard deviations are very similar to those obtained using the calculation procedure used by Jantzen et al., 0.98 and 0.83 (Appendix A). A more-detailed comparison of the results from the two calculation methods is given in Tables 2 through 4.

Two subsets of the leaching data base were also examined. The natural log of the 28-day normalized silica release was plotted against the standard and pH-corrected free energy of hydration for a set of waste glasses (Figures 3 and 4), and for a set of SRL glasses (Figures 5 and 6). The standard deviations of the waste glasses (0.45) and the SRL glasses (0.19) from best fit lines are much less than that for the entire set of glasses, possibly indicating that the glasses within each subset leach by similar mechanisms. It should also be

FIGURE 1. Natural Log of 28-Day Normalized Silica Release Plotted Against Standard Free Energy of Hydration for all Reported Glasses

FIGURE 2. Natural Log of 28-Day Normalized Silica Release Plotted Against pH-Corrected Free Energy of Hydration for all Reported Glasses

FIGURE 3. Natural Log of 28-Day Normalized Silica Release Plotted Against Standard Free Energy of Hydration for a Set of Waste Glasses

FIGURE 4. Natural Log of 28-Day Normalized Silica Release Plotted Against pH-Corrected Free Energy of Hydration for a Set of Waste Glasses

FIGURE 5. Natural Log of 28-Day Normalized Silica Release Plotted Against Standard Free Energy of Hydration for a Set of Savannah River Glasses

FIGURE 6. Natural Log of 28-Day Normalized Silica Release Plotted Against pH-Corrected Free Energy of Hydration for a Set of Savannah River Glasses

noted that the natural logs of the silica releases for identical glasses deviated up to 0.57. This deviation is much higher than the standard deviation of either the waste glasses or the SRL glasses.

RESULTS OF THE NONBRIDGING OXYGEN MODEL

The natural log of the 28-day normalized silica release was plotted against NBO and is shown in Figure 7. The standard deviation from the best fit line (1.16 natural logarithm units) and the maximum deviation from the best fit line (3.79 natural logarithm units) are higher than the deviations for the free energy model. However, the standard deviation from the best fit lines for the waste glasses (0.44 natural logarithm units) and SRL glasses (0.20 natural logarithm units) were much lower than the standard deviation for the entire data set, and the standard deviations are similar to the deviations for the free energy of hydration model (see Tables 2 and 3 and Figures 8 and 9).

RESULTS OF THE VALENCE-OXYGEN MODEL

The natural log of the 28-day normalized silica release was also plotted against the valence parameter for the same set of leaching data used in the free energy of hydration and NBO models. The standard deviation from the best fit line (Figure 10) is 0.97 natural logarithm units, and the maximum deviation is 2.95 natural logarithm units. These values are very similar to those for the free energy model. Plots for a set of waste glasses and a set of SRL glasses are plotted in Figures 11 and 12. The waste glasses (0.50) and SRL glasses (0.20) have standard deviations that are much less than that for the entire data set, as was also the case for the free energy model. Comparisons of the slopes and standard deviations for each model are given in Tables 2 and 3.

FIGURE 7. Natural Log of 28-Day Normalized Silica Release Plotted Against Nonbridging Oxygens for all Reported Glasses

TABLE 2. Standard Deviations from Best Fit Lines for All Models

Model (a)	Standard Deviation, Natural Logarithm Units			Description of Model
	All Glasses (b)	Waste Glasses (b)	SRL Glasses (b)	
Standard free energy of hydration	0.98 ^(c)	0.46	0.19	Assumes independent glass constituents and hydration reactions. Does not depend on solution effects such as pH.
pH-corrected free energy of hydration	0.83 ^(c)	0.45	0.19	Same as the standard free energy model, but includes pH effects.
NBO	1.16	0.44	0.20	A measure of the degree of crosslinking for a glass matrix.
Valence-oxygen	0.97	0.50	0.20	An empirical model to eliminate discrepancies between the free energy and NBO models.

(a) All models are assumed to follow the form $\ln(28\text{-day normalized Si release}) = A + B \cdot x$, where x is the model parameter and B is the reported slope (see Table 3).

(b) A standard deviation of 1 corresponds to an error of 63%, based on the equation that

$$\text{error} = \frac{(\text{predicted rate} - \text{observed rate})}{(\text{the larger of the two values})} \times 100.$$

A deviation of 0.5 corresponds to an error of 40%, and a deviation of 0.2 to an error of 20%. An error of more than 100% is not possible, based on this equation.

(c) Value obtained using the alternative calculation scheme (Appendix A) used by Jantzen et al.

TABLE 3. Slopes of the Best Fit Lines for All Models

Model	Slope for All Glasses (b)	Slope for Waste Glasses (b)	Slope for SRL Glasses (b)	Description of Model
Standard free energy of hydration	-0.28 ^(c)	-0.09	-0.10	Assumes independent glass constituents and hydration reactions. Does not depend on solution effects such as pH.
pH-corrected free energy of hydration	-0.26 ^(c)	-0.10	-0.10	Same as the standard free energy model, but includes pH effects.
NBO	2.97	2.66	2.55	A measure of the degree of crosslinking for a glass matrix.
Valence-oxygen	4.31	1.21	2.62	An empirical model to eliminate discrepancies between the free energy and NBO models.

- (a) All models have been fit to the form $\ln(28\text{-day normalized Si release}) = A + B \cdot x$, where x is the model parameter, and B is the reported slope.
- (b) The standard errors for these slopes are shown in Table 4.
- (c) Value obtained using the alternative calculator scheme (Appendix A) used by Jantzen et al.

TABLE 4. Standard Errors of the Slopes of the Best Fit Lines

Model	Standard Error ^(a)			Description of Model
	Slope for All Glasses	Slope for Waste Glasses	Slope for SRL Glasses	
Standard free energy of hydration	0.07 ^(b)	0.69	0.15	Assumes independent glass constituents and hydration reactions. Does not depend on solution effects such as pH.
pH-corrected free energy of hydration	0.05 ^(b)	0.54	0.13	Same as the standard free energy model, but includes pH effects.
NBO	0.11	0.58	0.16	A measure of the degree of crosslinking for a glass matrix
Valence-oxygen	0.06	1.07	0.17	An empirical model to eliminate discrepancies between the free energy and NBO models.

(a) The standard error is the absolute value of (reported error of slope)/(slope).

(b) Value obtained using alternative calculation scheme (Appendix A) used by Jantzen et al.

FIGURE 8. Natural Log of 28-Day Normalized Silica Release Plotted Against Nonbridging Oxygens for a Set of Waste Glasses

FIGURE 9. Natural Log of 28-Day Normalized Silica Release Plotted Against Nonbridging Oxygens for a Set of Savannah River Glasses

FIGURE 10. Natural Log of 28-Day Normalized Silica Release Plotted Against Valence Parameter for all Reported Glasses

FIGURE 11. Natural Log of 28-Day Normalized Silica Release Plotted Against Valence Parameter for a Set of Waste Glasses

FIGURE 12. Natural Log of 28-Day Normalized Silica Release Plotted Against Valence Parameter for a Set of Savannah River Glasses

FIGURE 12 - Value of 28-day Normalized Stress Ratio vs. 28-day Normalized Stress Ratio

FIGURE 12 - Value of 28-day Normalized Stress Ratio vs. 28-day Normalized Stress Ratio

REFERENCES

- Atkins, P. W. 1982. Physical Chemistry. W. H. Freeman and Co., San Francisco, California.
- Brewer, L., and K. S. Pitzer. 1961 Thermodynamics, McGraw Hill, New York, p. 269.
- Grambow, B. 1985. "A General Rate Equation for Nuclear Waste Glass Corrosion." Mat. Res. Soc. Symp. Proc. 44:16-27.
- Jantzen, C. M. 1986. Prediction of Nuclear Waste Glass Durability from Natural Analogs. DP-MS-86-95, E. I. Du Pont De Nemours, Inc., Aiken, South Carolina.
- Jantzen, C. M., and J. M. Plodinec. 1984. "Thermodynamic Model of Natural, Medieval and Nuclear Waste Glass Durability." Journal of Non-Crystalline Solids 67:207-223.
- Newton, R. G., and A. Paul. 1980. "A New Approach to Predicting the Durability of Glasses from Their Chemical Compositions." Glass Technology 21(6):307-309.
- Paul, A. 1977. "Chemical Durability of Glasses; a Thermodynamic Approach." Journal of Materials Science 12:2246-2268.
- Plodinec, J. M., C. M. Jantzen, and G. G. Wicks. 1984. "Stability of Radioactive Waste Glasses Assesses from Hydration Thermodynamics." Mat. Res. Soc. Symp. Proc. 26:755-762.
- Reimus, P. W., et al. 1986. Demonstration of an Approach to Waste Form Qualification Through Simulation of Liquid-Fed Ceramic Melter Process Operations. PNL-5919, Pacific Northwest Laboratory, Richland, Washington.
- Stevels, J. M. 1948. Progress in the Theory of The Physical Properties of Glass. Elsevier, New York.

1. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).
 2. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).
 3. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).
 4. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).
 5. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).
 6. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).
 7. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).
 8. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).
 9. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).
 10. J. H. Van Vleet, *Journal of the American Chemical Society*, **70**, 1000 (1948).

APPENDIX A

PROCEDURE FOR CALCULATION OF THE FREE ENERGY OF HYDRATION

APPENDIX A

PROCEDURE FOR CALCULATION OF THE FREE ENERGY OF HYDRATION

The following is the procedure for calculating the free pH-adjusted energy of hydration:

1. Obtain the weight percentages of each oxide.
2. Divide each percentage by the molecular weight of that oxide.
3. Calculate the moles of orthosilicates that are present. Oxides of the forms R_2O , RO , and ZrO_2 are assumed to be in the form R_2SiO_3 , $RSiO_3$ and $ZrSiO_4$, respectively. Subtract one mole of SiO_2 for each mole of orthosilicate that is formed. All other oxides are assumed to be in the original oxide form (See Table A.1.).
4. Calculate the total number of moles per 100 g of glass by summing the moles calculated in Step 3.
5. Divide each mole calculation of Step 3 by the result of Step 4 to get the appropriate mole fractions.
6. Multiply each mole fraction by the free energy of hydration for that species (see Table A.1.).
7. Sum the contributions of each constituent. This is the standard free energy of hydration for the glass.
8. Add a free energy contribution

$$\Delta G = 1.364 \left(-\log \left(1 + \frac{10^{-10}}{10^{-pH}} + \frac{10^{-21.994}}{10^{-2pH}} \right) \right)$$

for the dissociation of silicic acid (Jantzen 1986) to the results of Step 7.

TABLE A.1. Free Energy Calculations for PNL 76-68

Component	Molecular Weight	Standard Free Energy of Hydration, kcal/mole	Oxide, wt%	Oxide, Moles/100 g	Component, Moles/100 g	Component, Mole Fraction	Free Energy Contribution, kcal/mole	Jantzen's Energy Contribution, kcal/mole
Al ₂ O ₃	101.96	3.04	0.6	0.005884	0.005884	0.006383	0.019406	0.014772
B ₂ O ₃	69.6204	-9.93	8.81	0.126543	0.126543	0.137278	-1.36317	-1.03765
BaO	153.3394	-30.57	0.53	0.003456	0.003456	0.003749	-0.11462	-0.08725
CaO	56.0794	-16.116	2.36	0.042083	0.042083	0.045653	-0.73574	-0.56005
Cr ₂ O ₃	151.9974	37.36	0.15	0.000986	0.000986	0.001070	0.039996	0.030445
Cs ₂ O	281.8094	-46.82	1.02	0.003619	0.003619	0.003926	-0.18383	-0.13994
FeO	71.8464	-14.609	1.95	0.027141	0.027141	0.29443	-0.43014	-0.32742
Fe ₂ O ₃	159.6922	15.5	7.23	0.045274	0.045274	0.049115	0.761288	0.579498
K ₂ O	94.2034	-41.735	0.13	0.001379	0.001379	0.001497	-0.06247	-0.04756
Li ₂ O	29.8774	-22.74	0	0	0	0	0	0
MgO	40.3114	-13.888	0.15	0.003721	0.003721	0.004036	-0.05606	-0.04267
MnO	70.9374	-14.871	0.05	0.000704	0.000704	0.000764	-0.01137	-0.00865
Na ₂ O	61.979	-28.815	11.53	0.186030	0.186030	0.201812	-5.81522	-4.42659
Nd ₂ O ₃	336.4782	-28.32	6.82	0.020268	0.020268	0.021988	-0.62270	-0.47400
NiO	74.7094	-14.347	0.25	0.003346	0.003346	0.003630	-0.05208	-0.03964
P ₂ O ₅	141.937	-52.62	0.74	0.005213	0.005213	0.005655	-0.29761	-0.22654
PbO	223.19	-8.81	0	0	0	0	0	0
SiO ₂	60.0848	5.59	40.84	0.679706	0.390535	0.423665	2.368290	1.802760
SrO	103.6194	-24.4	0.42	0.004053	0.004053	0.004397	-0.10729	-0.08167
ThO ₂	264	-2.533	0	0	0	0	0	0
TiO ₂	79.8988	15.99	3.03	0.037922	0.037922	0.041140	0.657830	0.500745
UO ₂	270.0388	-6.8	0	0	0	0	0	0
ZrO ₂	123.2188	45.1	1.68	0.013634	0.013634	0.014790	0.667070	0.507779
Totals			88.29	1.210971	0.921800	1	-5.33847	-4.06368
							Sum+pH Si-5.60399	Sum+pH Si-4.32921
							Sum+pH B -6.52318	Sum+pH B -5.24839
							pH= 9.75	pH= 9.75

9. Add a free energy contribution

$$\Delta G = 1.364 \left(-\log \left(1 + \frac{10^{-9.18}}{10^{-\text{pH}}} + \frac{10^{-21.89}}{10^{-2\text{pH}}} + \frac{10^{-35.69}}{10^{-3\text{pH}}} \right) \right)$$

for the dissociation of boric acid (Jantzen 1986) to the results of Step 8. The result is the free energy of hydration. Do not include Step 9 if no B_2O_3 is present in the glass.

Free energy calculations for the waste glass PNL 76-68 are shown in Table A.1.

This calculation procedure was not identical to that used by Jantzen and Plodinec. Their method of calculating the free energy is:

1. Obtain the weight percentages of each oxide.
2. Divide each percentage by the molecular weight of that oxide.
3. Calculate the moles of orthosilicates that are present. Oxides of the forms R_2O , RO , and ZrO_2 are assumed to be in the form R_2SiO_3 , RSiO_3 and ZrSiO_4 , respectively. All other oxides are assumed to remain in their original oxide form.
4. Calculate the total number of oxide moles per 100 g of glass by summing the moles calculated in Step 2.
5. Subtract the total number of moles of R_2SiO_3 , RSiO_3 and ZrSiO_4 from the moles of SiO_2 .
6. Divide each mole calculation of Steps 3 and 5 by the result of Step 4.
7. Multiply each value of Step 6 by the corresponding free energy of hydration for that species.
8. Sum the contributions of each constituent. This is the standard free energy of hydration for the glass.

9. Add a free energy contribution

$$\Delta G = 1.364 \left(-\log \left(1 + \frac{10^{-10}}{10^{-\text{pH}}} + \frac{10^{-21.994}}{10^{-2\text{pH}}} \right) \right)$$

for the dissociation of silicic acid (Jantzen 1986) to the results of Step 8.

10. Add a free energy contribution

$$\Delta G = 1.364 \left(-\log \left(1 + \frac{10^{-9.18}}{10^{-\text{pH}}} + \frac{10^{-21.89}}{10^{-2\text{pH}}} + \frac{10^{-35.69}}{10^{-3\text{pH}}} \right) \right)$$

for the dissociation of boric acid (Jantzen 1986) to the results of Step 9. This is the free energy of hydration. Do not include this term if no B_2O_3 is present in the glass.

Newton, Paul, and Jantzen's procedure calculates each mole fraction by dividing the number of moles of a glass constituent by the total number of moles of original oxides (Table 1). In this report, each mole fraction is calculated by dividing the number of moles of a constituent by the total number of moles of glass constituents. Newton, Paul, and Jantzen normalize by the raw materials, but this report normalizes by the glass component species. The hydration energy is based on the glass composition species.

The natural log of 28-day normalized silica release is plotted against the free energy of hydration for some representative glass data (Figure A.1) to show how the results of the two calculation procedures differ. The plot shows that for the more resistant glasses (those with comparatively positive energies of hydration) the two procedures calculate very similar hydration energy values. For the less durable glasses (those with negative hydration energies which "drive" the dissolution process) the calculated hydration energies do differ. However, the same qualitative observations are made using either calculation procedure.

FIGURE A.1. Natural Log of 28-Day Normalized Silica Release Plotted Against pH-Adjusted Free Energy of Hydration for Representative Glass Data. The trends are similar despite slight differences in methods of calculation.

REFERENCE

Jantzen, C. M. 1986. Prediction of Nuclear Waste Glass Durability from Natural Analogs. DP-MS-86-95, E. I. DuPont De Nemours, Inc., Aiken, South Carolina

Figure 2.1. Theoretical and experimental nitrogen loss as a function of temperature. Theoretical nitrogen loss is calculated from the stoichiometry of the reaction. Experimental nitrogen loss is determined from the weight loss of the sample during the reaction.

Table 2.1. Theoretical and experimental nitrogen loss as a function of temperature. Theoretical nitrogen loss is calculated from the stoichiometry of the reaction. Experimental nitrogen loss is determined from the weight loss of the sample during the reaction.

APPENDIX B

PROCEDURE FOR CALCULATION OF THE VALENCE PARAMETER

APPENDIX B

PROCEDURE FOR CALCULATION OF THE VALENCE PARAMETER

The following is a description of the procedure used to calculate the valence parameter of Equation (4):

1. Obtain the weight percentages of each oxide.
2. Divide each percentage by the molecular weight of the corresponding oxide.
3. Sum the results of Step 2.
4. Divide the results of Step 2 by the result of Step 3 to get the mole fractions of the oxides.
5. Each oxide is of the form R_jO_x . Multiply the mole fractions obtained in Step 4 by the value of x corresponding to each oxide.
6. Sum the results of Step 5. This is the moles of oxygen atoms per mole of oxides.
7. Multiply the mole fractions of any oxides of the form R_2O from Step 5 by 3 and sum the results.
8. All other oxides of the form R_jO_x are multiplied by $(-x)$. Sum these results.
9. Add the results of Steps 7 and 8 and divide that result by the result of Step 6. This is the valence parameter.

Valence parameters for the waste glass PNL 76-68 are shown in Table B.1.

TABLE B.1. Spreadsheet of Valence Parameter Calculations for PNL 76-68

Component	Molecular Weight	Oxygen Coefficient	Valence Coefficient	Oxide, wt%	Oxide, Mole/100 g	Oxide, Mole Fraction	Valence Parameter Contribution Factor	Oxygen Contribution Factor
Al ₂ O ₃	101.96	3	-3	0.6	0.005884	0.004859	-0.01457	0.014578
B ₂ O ₃	69.6204	0	0	8.81	0.126543	0.104497	0	0
BaO	153.3394	1	-1	0.53	0.003456	0.002854	0.00285	0.002854
CaO	56.0794	1	-1	2.36	0.042083	0.034751	-0.03475	0.034751
Cr ₂ O ₃	151.9974	3	-3	0.15	0.000986	0.000814	-0.00244	0.002444
Cs ₂ O	281.8094	1	3	1.02	0.003619	0.002988	0.008966	0.002988
FeO	71.8464	1	-1	1.95	0.027141	0.022412	-0.2241	0.022412
Fe ₂ O ₃	159.6922	3	-3	7.23	0.045274	0.037387	-0.11216	0.112161
K ₂ O	94.2034	1	3	0.13	0.001379	0.001139	0.003418	0.001139
Li ₂ O	29.8774	1	3	0	0	0	0	0
MgO	40.3114	1	-1	0.15	0.003721	0.003072	-0.00307	0.003072
MnO	70.9374	1	-1	0.05	0.000704	0.000582	-0.00058	0.000582
Na ₂ O	61.979	1	3	11.53	0.186030	0.153621	0.460863	0.153621
Nd ₂ O ₃	336.4782	3	-3	6.82	0.020268	0.016737	-0.05021	0.050212
NiO	74.7094	1	-1	0.25	0.003346	0.002763	-0.00276	0.002763
P ₂ O ₅	141.937	5	-5	0.74	0.005213	0.004305	-0.02152	0.021526
PbO	223.19	1	-1	0	0	0	0	0
SiO ₂	60.0848	2	-2	40.84	0.679706	0.561289	-1.12257	1.122579
SrO	103.6194	1	-1	0.42	0.004053	0.003347	-0.00334	0.003347
ThO ₂	264	2	-2	0	0	0	0	0
TiO ₂	79.8988	2	-2	3.03	0.037922	0.031316	-0.06263	0.062632
UO ₂	270.0388	2	-2	0	0	0	0	0
ZrO ₂	123.2188	2	-2	1.68	0.013634	0.011258	-0.02251	0.022517
Totals				88.29	1.210971	1	-1.00518	1.636182

Valence
Parameter -0.61434

APPENDIX C

GLASS COMPOSITION DATA AND MODEL PARAMETERS

APPENDIX C

GLASS COMPOSITION DATA AND MODEL PARAMETERS

- The compositions listed in Appendix C are the un-normalized weight percentages of the oxides.
- 28-d NSi is the 28-day normalized Si release at 90°C in distilled H₂O for a S/V of 10 m⁻¹.
- pH is the measured pH after 28 days.
- St. G_{hyd} is the standard free energy of hydration of the glass (kcal/mole).
- Jantzen's G_{hyd} is the standard free energy of hydration (kcal/mole) calculated using Jantzen and Plodinec's procedure (1984).
- G_{hyd} is the pH corrected free energy of hydration (kcal/mole).
- Jantzen's G_{hyd} is the pH corrected free energy of hydration (kcal/mole) calculated with Jantzen and Plodinec's procedure (1984).
- NBO is the fraction of nonbridging oxygens calculated with Equation (4), from Jantzen and Plodinec (1984).
- Val. Par. is the valence-oxygen parameter, P, as calculated in Appendix B.
- Data 1 through 149 were obtained from C. M. Jantzen of SRL.
- Data 150 through 192 were obtained from S. O. Bates of PNL.
- Data 193 through 293 were obtained from Chick et al. (1984).
- Data point 294 was obtained from D. M. Strachan of PNL.
- Data point 295 was obtained from L. R. Eisenstatt of West Valley Nuclear Services Co.
- Data point 296 was obtained from Konnecke and Kirsch (1985).
- Data point 297 was obtained from Strachan, Pederson, and Lokken (1985).
- The title of the data base file is listed in the upper left hand corner of the pages of Appendix C.

- Data points 53, 58, 126, 129, 149, 198, 202, 214, 229, 247, 267, and 277 were not included in the free energy model calculations. The compositions of these glasses lead to a negative mole fraction of SiO_2 . This limitation is inherent in the free energy calculation used in this report (Appendix A) when applied to "silica-depleted" glasses.
- The data base is located on the BWIP MicroVax II computer system located in the 3764 Building.
- SRL glasses include glasses 10-49. Waste glasses include glasses 1-9 and 294-297.

REFERENCES

- Chick, L. A., et al. 1984. West Valley High-Level Nuclear Waste Glass Development: A Statistically Designed Mixture Study. PNL-4992, Pacific Northwest Laboratory, Richland, Washington.
- Konnecke, R., and J. Kirsch. 1985. Summary Report of a European Community Interlaboratory Round Robin. EUR 9772, in Nuclear Science and Technology, Commission of the European Communities, Brussels and Luxembourg.
- Jantzen, C. M., and J. M. Plodinec. 1984. "Thermodynamic Model of Natural, Medieval and Nuclear Waste Glass Durability." Journal of Non-Crystalline Solids 67:207-223.
- Strachan D. M., L. R. Pederson, and R. O. Lokken. 1985. Results from the Long-Term Interaction and Modeling of SRL-131 Glass with Aqueous Solutions. PNL-5654, Pacific Northwest Laboratory, Richland, Washington.

0 Glass	1 Al2O3	2 CaO	3 Fe2O3	4 FeO	5 MgO	6 MnO	7 Na2O	8 Li2O	9 NiO	10 SiO2	11 Cr2O3
1 M2	8.8600	0.0000	2.6900	0.7300	0.0000	0.9200	14.6300	0.0000	0.540000	43.9800	0.000000
2 M3	4.2000	4.2500	1.0900	0.3000	0.3600	0.7900	13.6700	0.0000	0.470000	52.9900	0.000000
3 M4	6.0800	0.0000	1.8200	0.4900	0.0000	1.1300	9.1200	0.0000	0.670000	47.2800	0.000000
4 M5	3.1100	2.0800	2.0000	0.5400	0.0000	0.8900	12.9800	2.0800	0.520000	51.9000	0.000000
5 M6	2.0800	3.9800	2.0000	0.5400	0.0000	0.8900	11.7100	0.0000	0.520000	50.2400	0.360000
6 MCC 76-88	0.6000	2.3600	7.2300	1.9500	0.1500	0.0500	11.5300	0.0000	0.250000	40.8400	0.150000
7 AECL	19.1000	18.8000	2.1500	0.5800	0.4000	0.0000	11.7000	0.0000	0.200000	46.3000	0.400000
8 JAP GB7	4.8371	1.1641	7.1400	1.9300	0.0758	0.2378	8.4789	1.9394	1.265000	50.0596	0.461900
9 JAP G2	6.7266	1.9589	6.8800	1.8600	0.0688	0.2634	8.4250	3.1427	0.500000	45.7810	0.445800
10 131AT30%	3.3690	1.2030	10.9200	2.0500	2.2800	3.3200	13.6700	3.9900	4.060000	43.8700	0.000000
11 105 BLACK	4.5000	1.7400	5.5300	4.9200	0.6900	1.8700	9.9700	5.1700	0.990000	53.1600	0.000000
12 131AT50%	5.8200	2.0000	10.2000	4.9200	1.0000	5.5500	10.9900	2.8500	2.900000	34.5200	0.000000
13 105MM	3.9800	1.4900	8.3700	2.2600	0.7100	2.6800	11.5500	5.1000	0.770000	54.4200	0.000000
14 SRLS2	5.0300	1.5000	9.9100	2.8800	0.7200	3.5700	13.6400	0.0000	1.000000	46.4300	0.000000
15 SRLS12	7.5500	2.3700	14.8400	4.0100	0.5800	5.3500	8.2000	8.2500	1.620000	39.6400	0.000000
16 SRLS10	7.5500	2.3700	14.8400	4.0100	0.5800	5.3500	8.2000	8.2500	1.620000	47.8900	0.000000
17 SRLS17	5.0300	1.5000	9.9100	2.8800	0.7200	3.5700	10.4900	5.2500	1.000000	51.6800	0.000000
18 SRL 100	4.8650	1.5300	9.5600	2.5900	0.7300	3.4500	10.2300	4.2600	1.040000	46.3000	0.000000
19 SRL 100	4.8650	1.5300	9.5600	2.5900	0.7300	3.4500	10.2300	4.2600	1.040000	46.3000	0.000000
20 TNX105	0.0000	2.1128	9.0400	2.4400	0.7031	1.7889	8.7939	4.3050	1.024400	52.0278	0.049700
21 106AL	10.2222	1.4272	5.8475	1.5824	0.8723	1.4591	8.5483	4.0252	0.979900	52.9263	0.190000
22 SRL131TDS	10.7702	1.5251	8.9499	2.4186	1.4328	2.4533	9.1268	3.1642	0.959500	44.3263	0.176900
23 SRL105AL	10.2279	1.4272	5.8332	1.5747	0.8723	1.4591	8.5483	4.0252	0.979900	52.9263	0.190000
24 SRL131FE	3.5145	1.1501	12.5385	3.3835	1.3268	3.3055	14.6932	4.0252	2.112500	35.7263	0.233900
25 SRL105TDS	8.0484	1.8190	10.2224	2.7647	0.9884	2.2725	9.0181	4.3285	1.259900	52.0000	0.204600
26 SRL105TDS	8.0484	1.8190	10.2224	2.7647	0.9884	2.2725	9.0181	4.3285	1.259900	52.0000	0.204600
27 SRL131AL	11.1858	1.8749	6.7482	1.8268	1.8075	1.8269	9.9213	3.9178	1.005400	47.9203	0.204600
28 SRL131FE	3.5145	1.1501	12.5328	3.3835	1.3268	3.3055	14.6932	4.0252	2.112500	35.7263	0.233900
29 SRL131AL	11.1858	1.8749	6.7482	1.8268	1.8075	1.8269	9.9213	3.9178	1.005400	47.9203	0.204600
30 SRL131TDS	7.3502	1.4892	5.8618	1.5824	1.4593	1.4591	14.4236	3.5732	1.005400	44.0896	0.263100
31 SRL105FE	2.5897	1.1813	11.8808	3.2034	0.8789	2.5804	14.8280	3.9391	1.272600	47.4925	0.219200
32 SRL131TDS	7.3502	1.4892	5.8761	1.5824	1.4593	1.4591	14.4236	3.5732	1.005400	44.0896	0.263100
33 AH1	4.1900	1.3200	9.0000	2.4300	0.6300	2.0240	11.7600	4.4000	0.930000	47.4800	0.000000
34 AH2	4.4400	0.8400	9.0000	2.4300	0.6400	2.6200	11.2300	3.8400	0.980000	42.6500	0.000000
35 AH3	4.1900	1.3200	9.0000	2.4300	1.2800	2.0240	10.5100	3.1400	0.930000	48.7400	0.000000
36 AH4	4.1900	1.3200	9.0000	2.4300	0.7000	2.0240	10.0000	4.0000	0.930000	52.0000	0.000000
37 AH5	4.4400	0.8400	8.8900	2.4000	0.6400	2.6200	9.3100	3.8400	0.980000	51.6100	0.000000
38 AH6	4.4400	0.8400	8.8900	2.4000	0.6400	2.6200	11.2300	4.4800	0.980000	46.4900	0.000000
39 AH7	4.4400	0.8400	8.8900	2.4000	0.6400	2.6200	9.3100	3.2000	0.980000	47.7700	0.000000
40 AH8	4.4400	0.8400	8.8900	2.4000	1.2800	2.6200	9.9500	3.2000	0.980000	47.7700	0.000000
41 AH9	4.4400	0.8400	8.8900	2.4000	0.6400	2.6200	9.3100	3.5200	0.980000	49.8900	0.000000
42 AH10	4.4400	0.8400	8.8900	2.4000	1.2800	2.6200	8.7500	4.4800	0.980000	52.2500	0.000000
43 AH11	4.4400	0.8400	8.8900	2.4000	1.2800	2.6200	8.7500	3.8400	0.980000	48.4100	0.000000
44 AH12	5.5000	1.7200	11.1200	3.0000	0.5700	3.2900	10.4700	3.3900	1.230000	36.7600	0.000000
45 AH13	5.5000	1.7200	11.1200	3.0000	0.5700	3.2900	8.7700	3.3900	1.230000	46.6700	0.000000
46 AH14	5.5000	1.7200	11.1200	3.0000	0.5700	3.2900	10.4700	3.9800	1.230000	42.1500	0.000000
47 AH15	5.5000	1.7200	11.1200	3.0000	1.1300	3.9800	9.3400	2.8300	1.230000	43.2800	0.000000
48 AH131	4.2600	0.8400	8.8900	2.4000	1.4400	2.6200	13.5900	4.1000	0.980000	44.8800	0.000000
49 AH105	4.2600	0.8400	8.8900	2.4000	0.7200	2.6200	10.2100	5.0400	0.980000	51.9300	0.000000
50 ESF151	3.9000	19.0000	0.3000	0.0000	3.2000	0.5000	5.0000	0.0000	0.000000	56.0000	0.000000
51 ESF77-33	4.1000	22.6000	2.5000	0.0000	0.0500	0.0500	21.7000	0.0000	0.000000	48.7000	0.000000
52 ESF144	3.9000	20.8000	2.1000	0.0000	0.0400	0.0500	1.1000	0.0000	0.000000	43.8000	0.000000
53 ESF168	3.8000	28.4000	0.0000	0.0000	0.0600	0.1000	0.1000	0.0000	0.100000	42.6000	0.000000
54 ESF147	3.8000	30.1000	0.0000	0.0000	0.0500	0.0000	0.1000	0.0000	0.000000	48.7000	0.000000

0 Glass	12 B203	13 U02	14 SrO	15 ZrO2	16 TiO2	17 K2O	18 Cs2O	19 Sb2O3	20 P2O5	21 Nd2O3
1 M2	18.3300	0.000000	0.380000	1.860000	0.0000	0.000000	1.280000	0.0000	0.000000	4.650000
2 M3	14.0500	0.000000	0.000000	0.330000	1.0100	0.000000	1.110000	0.0000	0.000000	4.020000
3 M4	22.8100	0.000000	0.480000	2.340000	0.0000	0.000000	1.820000	0.0000	0.000000	5.860000
4 M5	14.9600	0.000000	0.360000	1.810000	0.0000	0.000000	1.250000	0.0000	0.000000	4.510000
5 M6	19.1700	0.000000	0.000000	1.810000	0.0000	0.000000	1.250000	0.0000	0.000000	4.510000
6 MCC 76-68	8.8100	0.000000	0.420000	1.680000	3.0300	0.130000	1.020000	0.0000	0.740000	6.820000
7 AECL	0.0000	1.100000	0.100000	0.000000	0.2000	3.900000	0.010000	0.0000	0.000000	0.000000
8 JAP GB7	9.2739	0.000000	0.365400	2.120800	0.0310	1.000000	0.042400	0.0000	0.000000	6.100000
9 JAP G2	9.4671	0.189400	0.415100	2.120800	0.0259	2.084000	1.000000	0.0000	0.000000	6.100000
10 131AT30%	10.2900	0.000000	0.000000	0.350000	0.7000	0.000000	0.000000	0.0000	0.000000	0.350000
11 165 BLACK	7.3000	1.080000	0.080000	0.670000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
12 131AT50%	7.3500	0.000000	0.000000	0.250000	0.5000	0.000000	0.000000	0.0000	0.000000	0.500000
13 165MM	7.1400	0.000000	0.100000	0.710000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
14 SRLS2	14.0000	0.000000	0.000000	0.700000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
15 SRLS12	11.0000	0.000000	0.000000	0.550000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
16 SRLS16	0.0000	0.000000	0.000000	0.550000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
17 SRLS17	8.6500	0.000000	0.000000	0.700000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
18 SRL 168	12.0700	0.000000	0.000000	0.710000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
19 SRL 168	12.0700	0.000000	0.000000	0.710000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
20 TNX165	7.2774	0.000000	0.013000	0.763500	0.2085	4.613600	0.000000	0.0000	0.000000	0.000000
21 165AL	8.5977	0.084800	0.047300	1.053600	0.0667	0.000000	0.000000	0.0000	0.000000	0.000000
22 SRL131TDS	11.3670	2.132700	0.047300	0.483600	0.7272	0.000000	0.000000	0.0000	0.012600	0.000000
23 SRL165AL	8.5977	0.084800	0.048100	1.053600	0.0667	0.000000	0.000000	0.0000	0.137500	0.000000
24 SRL131FE	12.0754	1.134400	0.071000	0.499800	0.7640	0.000000	0.000000	0.0000	0.000000	0.000000
25 SRL165TDS	8.9841	1.191100	0.059100	0.720000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
26 SRL165TDS	8.9841	1.191100	0.059100	0.720000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
27 SRL131AL	10.1111	0.998300	0.047300	0.540300	0.0634	0.000000	0.000000	0.0000	0.000000	0.000000
28 SRL131FE	12.0754	1.134400	0.071000	0.499800	0.7640	0.000000	0.000000	0.0000	0.000000	0.000000
29 SRL131AL	10.1111	0.998300	0.047300	0.540300	0.0634	0.000000	0.000000	0.0000	0.000000	0.000000
30 SRL131TDS	8.0231	2.132700	0.047300	0.499800	0.8173	0.060200	0.000000	0.0000	0.000000	0.000000
31 SRL165FE	11.5602	0.000000	0.071000	0.563800	0.8006	0.000000	0.137600	0.0000	0.000000	0.000000
32 SRL131TDS	8.0231	2.132700	0.047300	0.499800	0.8173	0.060200	0.000000	0.0000	0.000000	0.000000
33 AH1	8.6500	0.000000	0.040000	0.620000	1.2600	3.190000	0.090000	0.0000	0.000000	0.000000
34 AH2	13.2600	0.000000	0.050000	0.640000	1.3000	3.200000	0.060000	0.0000	0.000000	0.000000
35 AH3	9.9100	0.000000	0.040000	0.000000	1.2600	3.190000	0.090000	0.0000	0.000000	0.000000
36 AH4	6.9000	0.000000	0.040000	0.000000	1.2600	3.190000	0.090000	0.0000	0.000000	0.000000
37 AH5	6.8600	0.000000	0.050000	0.000000	1.3000	3.200000	0.060000	0.0000	0.000000	0.000000
38 AH6	8.7800	0.000000	0.050000	0.640000	1.3000	3.200000	0.060000	0.0000	0.000000	0.000000
39 AH7	11.3400	0.000000	0.050000	0.000000	1.3000	3.200000	0.060000	0.0000	0.000000	0.000000
40 AH8	10.0600	0.000000	0.050000	0.000000	1.3000	3.200000	0.060000	0.0000	0.000000	0.000000
41 AH9	9.1000	0.000000	0.050000	0.000000	1.3000	3.200000	0.060000	0.0000	0.000000	0.000000
42 AH10	7.5000	0.000000	0.050000	0.000000	1.3000	3.200000	0.060000	0.0000	0.000000	0.000000
43 AH11	11.9900	0.000000	0.050000	0.000000	1.3000	3.200000	0.060000	0.0000	0.000000	0.000000
44 AH12	11.9900	0.000000	0.000000	0.570000	1.3000	3.200000	0.064000	0.0000	0.000000	0.000000
45 AH13	6.3400	0.000000	0.060000	0.570000	1.3000	3.200000	0.064000	0.0000	0.000000	0.000000
46 AH14	8.0300	0.000000	0.060000	0.570000	1.3000	3.200000	0.064000	0.0000	0.000000	0.000000
47 AH15	9.1600	0.000000	0.060000	0.000000	1.3000	3.200000	0.064000	0.0000	0.000000	0.000000
48 AH131	10.5800	0.000000	0.050000	0.360000	2.0200	0.000000	0.060000	0.0000	0.000000	0.360000
49 AH165	7.2000	0.000000	0.050000	0.720000	1.3000	0.000000	0.060000	0.0000	0.000000	0.000000
50 ESF151	0.0000	0.000000	0.000000	0.000000	0.2000	7.200000	0.000000	0.0000	3.900000	0.000000
51 ESF77-33	0.0000	0.000000	0.000000	0.000000	0.1000	0.000000	0.000000	0.0000	0.000000	0.000000
52 ESF144	0.0000	0.000000	0.000000	0.000000	0.1000	29.500000	0.000000	0.0000	0.000000	0.000000
53 ESF156	0.0000	0.000000	0.000000	0.000000	0.0000	24.200000	0.000000	0.0000	0.000000	0.000000
54 ESF147	0.0000	0.000000	0.100000	0.100000	0.5000	14.600000	0.000000	0.0000	0.000000	0.000000

0 Glass	22 BaO	23 PbO	24 ThO2	25 28-D NSi (g/m**2)	26 pH	27 St. Ghyl (KC/Mol)	28 Jantzen's St. Ghyl	29 Ghyl (KC/Mol)	30 Jantzen's Ghyl
1 M2	0.6700	0.0000	0.000000	7.800000	8.500000	-6.321225	-4.999913	-6.452075	-5.130763
2 M3	0.5800	0.0000	0.000000	4.200000	8.350000	-5.984188	-4.824134	-6.059024	-4.718971
3 M4	0.8400	0.0000	0.000000	10.600000	8.500000	-3.888025	-3.278748	-3.996875	-3.408698
4 M5	0.6400	0.0000	0.000000	9.200000	9.100000	-8.902608	-5.205965	-7.331554	-5.634912
5 M6	0.6400	0.0000	0.000000	14.800000	8.800000	-5.563879	-4.394287	-5.808582	-4.836990
6 MCC 78-88	0.5300	0.0000	0.000000	23.900000	9.750000	-5.344103	-4.067972	-6.528813	-5.252882
7 AECL	0.0000	0.0000	0.000000	16.600000	8.210000	-11.192238	-7.000776	-11.201769	-7.010307
8 JAP GB7	1.7000	0.0000	0.000000	9.000000	7.800000	-4.203543	-3.256540	-4.231463	-3.284480
9 JAP G2	0.7000	0.0000	0.000000	9.800000	7.810000	-8.457007	-4.764680	-6.485568	-4.793238
10 131AT30X	0.0000	0.0000	0.000000	17.100000	9.480000	-11.941445	-7.541239	-12.748283	-8.348076
11 165 8LACK	0.0000	0.0000	0.000000	15.310000	9.500000	-8.238635	-6.640547	-9.068274	-6.472186
12 131AT50X	0.0000	0.0000	0.000000	15.900000	9.390000	-11.182435	-6.955611	-11.883908	-7.857084
13 165MM	0.0000	0.0000	0.000000	13.230000	9.500000	-7.826100	-5.422382	-7.956950	-5.553232
14 SRLS2	0.0000	0.0000	0.000000	16.170000	9.000000	-8.378381	-4.747487	-8.735416	-5.104522
15 SRLS12	0.0000	0.0000	0.000000	25.810000	9.000000	-10.092787	-6.510635	-11.357661	-7.775510
16 SRLS15	0.0000	0.0000	0.000000	18.885000	10.000000	-9.469277	-5.888720	-9.888277	-6.302320
17 SRLS17	0.0000	0.0000	0.000000	22.505000	10.000000	-8.073889	-5.505941	-9.890262	-7.122514
18 SRL 188	0.0000	0.0000	0.000000	18.570000	8.200000	-7.919409	-5.570628	-7.987719	-5.638939
19 SRL 188	0.0000	0.0000	0.000000	19.600000	9.440000	-7.919409	-5.570628	-8.878161	-6.329380
20 TNX165	0.0000	0.0000	0.000000	17.800000	9.840000	-7.589263	-5.328908	-8.920554	-6.680177
21 165AL	0.0000	0.0000	0.000000	7.813582	8.900000	-4.997343	-3.742565	-5.292594	-4.037816
22 SRL131TDS	0.0000	0.0000	0.000000	18.800000	9.850000	-6.501855	-4.741344	-7.850038	-6.089527
23 SRL165AL	0.1563	0.2586	0.000000	8.610000	9.040000	-5.084063	-3.803179	-5.488601	-4.187718
24 SRL131FE	0.0000	0.0000	0.000000	23.770000	9.200000	-13.694880	-8.476784	-14.208855	-8.988539
25 SRL185TDS	0.0000	0.0000	0.000000	13.490000	9.580000	-6.307011	-4.530527	-7.242947	-5.488463
26 SRL185TDS	0.0000	0.0000	0.000000	14.280000	8.850000	-6.307011	-4.530527	-6.574892	-4.798407
27 SRL131AL	0.0000	0.0000	0.000000	13.710000	8.770000	-7.145891	-5.118021	-6.374288	-5.348619
28 SRL131FE	0.0000	0.0000	0.000000	41.950000	9.970000	-13.696042	-8.477355	-15.256761	-10.038073
29 SRL131AL	0.0000	0.0000	0.000000	13.280000	8.970000	-7.145891	-5.118021	-7.483168	-5.456497
30 SRL131TDS	0.0000	0.0000	0.000000	22.230000	9.160000	-9.993477	-6.746491	-10.470765	-7.223779
31 SRL165FE	0.0000	0.0000	0.000000	24.800000	9.100000	-9.811465	-6.610281	-10.240411	-7.039227
32 SRL131TDS	0.0000	0.0000	0.000000	20.490000	9.180000	-9.991168	-6.745131	-10.485470	-7.239433
33 AH1	0.0000	0.0000	0.000000	17.120000	8.770000	-9.758289	-6.605205	-9.988888	-6.833802
34 AH2	0.0000	0.0000	0.000000	16.750000	8.150000	-10.128105	-6.952386	-10.189271	-7.013552
35 AH3	0.0000	0.0000	0.000000	18.830000	8.920000	-8.180782	-5.782137	-8.487801	-6.088978
36 AH4	0.0000	0.0000	0.000000	21.390000	8.660000	-7.640437	-5.405903	-7.913613	-5.679079
37 AH5	0.0000	0.0000	0.000000	15.710000	8.360000	-7.167096	-5.124391	-7.264010	-5.221305
38 AH6	0.0000	0.0000	0.000000	18.730000	8.980000	-9.758062	-6.802320	-10.089218	-6.933475
39 AH7	0.0000	0.0000	0.000000	15.450000	8.350000	-7.526919	-5.460204	-7.621755	-5.555040
40 AH8	0.0000	0.0000	0.000000	18.850000	8.830000	-8.114892	-5.755500	-8.372445	-6.013053
41 AH9	0.0000	0.0000	0.000000	15.590000	8.580000	-7.336647	-5.284382	-7.491516	-5.439262
42 AH10	0.0000	0.0000	0.000000	15.560000	8.840000	-8.603904	-4.758020	-6.866578	-5.021494
43 AH11	0.0000	0.0000	0.000000	15.030000	8.830000	-6.957422	-5.085949	-7.214975	-5.343502
44 AH12	0.0000	0.0000	0.000000	20.750000	8.880000	-10.596784	-7.101001	-10.880818	-7.385033
45 AH13	0.0000	0.0000	0.000000	19.800000	8.910000	-7.599194	-5.275733	-7.900192	-5.676732
46 AH14	0.0000	0.0000	0.000000	20.200000	9.100000	-10.246770	-6.774847	-10.675718	-7.203794
47 AH15	0.0000	0.0000	0.000000	19.480000	8.880000	-8.880366	-8.098159	-9.153532	-6.389335
48 AH131	0.0000	0.0000	0.000000	20.170000	9.640000	-9.856987	-6.637576	-10.876510	-7.657099
49 AH165	0.0000	0.0000	0.000000	15.700000	9.380000	-8.983282	-4.911210	-7.673873	-5.601602
50 ESF161	0.0000	0.7100	0.000000	134.000000	9.940000	-11.536347	-7.281769	-11.909874	-7.655296
51 ESF77-33	0.2000	0.0000	0.000000	84.000000	9.810000	-18.398616	-9.829614	-16.896221	-10.126219
52 ESF144	0.2000	0.0000	0.000000	183.200000	10.750000	-23.812740	-12.864574	-24.980699	-13.812533
53 ESF150	0.0000	0.1400	0.000000	109.000000	10.800000	-25.757894	-12.679096	-26.727851	-13.649054
54 ESF147	0.0000	0.0000	0.000000	95.340000	9.840000	-16.764193	-9.234661	-17.077369	-9.547837

Ø Glass	31 NBO	32 Val. Per.	33
1 M2	0.350975	-0.547293	2.054124
2 M3	0.490408	-0.613601	1.435085
3 M4	0.318055	-0.700558	2.380854
4 M5	0.507374	-0.502988	2.219203
5 M6	0.460018	-0.638877	2.694627
6 MCC 76-88	0.646190	-0.614348	3.173878
7 AECL	0.619880	-0.685353	2.809403
8 JAP GB7	0.435280	-0.636526	2.203869
9 JAP G2	0.486025	-0.535815	2.288486
10 131AT30%	0.637443	-0.401139	2.842581
11 185 BLACK	0.546744	-0.468438	2.728508
12 131AT50%	0.538091	-0.503276	2.771984
13 185MM	0.508313	-0.448229	2.582487
14 SRLS2	0.368379	-0.610168	2.783158
15 SRLS12	0.498920	-0.448038	3.219278
16 SRLS15	0.546578	-0.445749	2.928850
17 SRLS17	0.501100	-0.460410	3.113738
18 SRL 188	0.481129	-0.485904	2.921547
19 SRL 188	0.481129	-0.485904	2.975530
20 TNX165	0.535818	-0.485039	2.879198
21 165AL	0.360106	-0.576897	2.055884
22 SRL131TDS	0.379278	-0.570735	2.821379
23 SRL185AL	0.352230	-0.578011	2.152924
24 SRL131FE	0.658721	-0.297437	3.188424
25 SRL165TDS	0.429572	-0.548407	2.801949
26 SRL185TDS	0.429572	-0.548407	2.868880
27 SRL131AL	0.393073	-0.535017	2.618125
28 SRL131FE	0.658787	-0.297401	3.738478
29 SRL131AL	0.393073	-0.535017	2.584752
30 SRL131TDS	0.563400	-0.390074	3.101443
31 SRL165FE	0.663250	-0.387220	3.202748
32 SRL131TDS	0.563243	-0.390145	3.019937
33 AH1	0.568038	-0.381331	2.840247
34 AH2	0.543141	-0.380759	2.818398
35 AH3	0.495384	-0.482033	2.935451
36 AH4	0.488382	-0.473008	3.062924
37 AH5	0.481184	-0.494437	2.754297
38 AH6	0.564858	-0.382952	2.930127
39 AH7	0.459034	-0.498835	2.737809
40 AH8	0.491851	-0.488881	2.938513
41 AH9	0.489958	-0.498878	2.748630
42 AH10	0.470855	-0.529848	2.744704
43 AH11	0.448814	-0.536488	2.710048
44 AH12	0.538790	-0.418233	3.032548
45 AH13	0.492433	-0.519098	2.985682
46 AH14	0.558227	-0.418538	3.005683
47 AH15	0.501017	-0.513048	2.989388
48 AH131	0.599362	-0.387594	3.004196
49 AH165	0.516812	-0.489483	2.753881
50 ESF151	0.693351	-0.768313	4.897840
51 ESF77-33	0.865785	-0.450259	4.430817
52 ESF144	0.889492	-0.450932	5.094976
53 ESF158	0.988351	-0.550348	4.891348
54 ESF147	0.887402	-0.743549	4.557449

0 Glass	1 Al2O3	2 CaO	3 Fe2O3	4 FeO	5 MgO	6 MnO	7 Na2O	8 Li2O	9 NiO	10 SiO2	11 Cr2O3
55 ESF148	3.9000	25.9000	0.4000	0.0000	0.0500	0.2000	0.1000	0.0000	0.000000	53.8000	0.000000
56 ESF149	4.2000	21.5000	0.0000	0.0000	0.0500	1.8000	0.1000	0.0000	0.000000	50.8000	0.000000
57 ESF150	4.3000	21.9000	0.3000	0.0000	0.0000	0.0000	9.5000	0.0000	0.000000	55.4000	0.000000
58 ESF159	3.9000	34.9000	0.1000	0.0000	0.0700	1.0000	0.0000	0.0000	0.000000	44.0000	0.000000
59 A&T	12.2062	2.4626	0.0000	5.5062	1.9236	0.1291	1.6985	0.0215	0.000000	89.3133	0.000000
60 CORNING	12.1873	2.7144	0.0000	1.4666	1.8739	0.0000	4.4349	0.0000	0.000000	74.4478	0.000000
61 OBSIDIAN	0.0000	1.3992	0.0000	5.1460	0.2487	0.0000	1.4424	0.0000	0.000000	73.5919	0.000000
62 CORNING	12.1873	2.7144	0.0000	1.4666	1.8739	0.0000	4.4349	0.0000	0.000000	74.4478	0.000000
63 RRL2-3134	13.0564	3.6379	0.0000	9.8000	0.5688	0.2415	3.0734	0.0000	0.000000	59.4725	0.000000
64 OBSIDIAN	0.0000	1.3992	0.0000	5.7090	0.2487	0.0000	1.4424	0.0000	0.000000	73.5919	0.000000
65 GQT	12.4329	16.3912	0.0000	12.4405	4.3282	1.0794	0.8897	0.0215	0.137400	44.2835	0.019400
66 GQT	13.6989	16.6505	0.0000	12.9937	4.7593	1.0794	0.8897	0.0000	0.000000	54.5622	0.013200
67 GQT	13.1887	5.8626	0.0000	6.2267	21.2262	0.0551	0.1591	0.0000	0.000000	48.3482	0.022900
68 GQN	13.0376	5.8766	0.0000	5.4162	4.4774	0.0439	0.6201	0.0151	0.025500	88.8855	0.019000
69 DQH	18.1014	8.8290	0.0000	0.0000	2.9684	0.1214	1.6176	0.0215	0.016300	61.4407	0.020500
70 DQF	12.5633	4.4748	3.9600	0.0000	0.6981	0.0518	6.0000	0.0431	0.025500	72.3511	0.023400
71 GRF	8.4658	10.9637	0.0000	16.5959	0.5689	0.1240	0.2831	0.0431	0.025500	45.2034	0.031300
72 SILICA GLASS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000000	100.0000	0.000000
73 SILICA GLASS	0.3904	0.8464	0.0000	0.8762	0.1415	0.1894	0.0310	0.0000	0.082100	93.0160	0.083400
74 PYREX 7740	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.000000	81.0000	0.000000
75 PYREX CMJ	2.0000	0.0000	0.0000	0.0000	0.0000	0.0000	4.0000	0.0000	0.000000	81.0000	0.000000
76 WINDOW	0.5000	13.1000	0.0000	0.0000	1.7000	0.0000	13.9000	0.0000	0.000000	70.8000	0.000000
77 PB GLASS	4.2136	1.5111	9.0071	0.0000	0.0000	2.8019	0.0000	0.0000	0.000000	50.7014	0.000000
78 NBS	3.6800	0.1400	0.1000	0.0000	0.0000	0.0000	2.6800	0.4600	0.000000	60.5200	0.000000
79 LIBYAN DESSERT	0.0000	0.8115	0.0000	1.9040	0.0683	0.0258	0.1078	0.1937	0.003800	92.4178	0.068500
80 CIA	0.7900	1.0500	7.1100	9.4200	0.0000	4.8000	2.3000	5.7000	2.000000	59.0000	0.000000
81 FRIT 131	0.0000	0.0000	0.0000	0.0000	2.1000	0.0000	17.2000	3.6000	0.000000	52.5000	0.000000
82 FRIT21	0.0000	4.2000	0.0000	0.0000	0.0000	0.0000	20.6000	4.4000	0.000000	58.3000	0.000000
83 FRIT211	0.0000	5.6000	0.0000	0.0000	2.0000	0.0000	13.5000	4.5000	0.000000	87.0000	0.000000
84 FRIT153	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	8.0000	15.0000	0.000000	75.0000	0.000000
85 FRIT S15	0.0000	0.0000	0.0000	0.0000	0.9711	0.0000	12.4018	5.9840	0.178200	59.3442	0.000000
86 FRIT 108A	1.2524	0.6716	0.3431	0.0000	1.0000	0.0000	3.0000	16.0000	0.000000	60.0000	0.000000
87 FRIT S12	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	18.0000	0.0000	0.000000	80.0000	0.000000
88 FRIT S2	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	13.0000	7.0000	0.000000	88.0000	0.000000
89 FRIT165	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	13.0000	7.0000	0.000000	88.0000	0.000000
90 FRIT 168	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	13.0000	7.0000	0.000000	88.0000	0.000000
91 FRIT 165	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	13.0000	7.0000	0.000000	88.0000	0.000000
92 FRIT S17	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	13.0000	7.0000	0.000000	88.0000	0.000000
93 UNTANUM	12.0550	7.8075	0.0000	14.1515	3.9633	0.2479	4.7989	0.0000	0.131100	46.2089	0.022400
94 LLNLS29	20.3800	6.3000	0.0000	4.6700	2.5000	1.6500	12.6200	0.0000	0.000000	36.6000	0.000000
95 BGC-50	12.0000	5.5000	0.9210	0.0000	5.7500	0.1700	9.0000	0.0000	0.000000	40.8500	0.030000
96 HANFORD BASALT	13.0900	9.4700	0.0000	9.6800	0.0332	0.0000	0.1618	4.1328	0.356300	65.8904	0.000000
97 SPODUMENE GL CERAM	21.5403	0.5597	0.2145	0.0000	0.0332	0.0000	0.1618	4.1328	0.356300	65.8904	0.000000
98 SPODUMENE GLASS	21.5403	0.5597	0.2145	0.0000	0.0332	0.0000	0.1618	4.1328	0.356300	65.8904	0.000000
99 POMONA	14.3791	11.0537	0.0000	12.6849	0.7659	0.2208	1.8488	0.0000	0.124200	50.4875	0.000000
100 STRIPA GRANITE	13.3399	0.8297	0.0000	1.6725	0.1973	0.0414	4.0170	0.0215	0.224000	71.6868	0.037100
101 COHASSET	13.1320	7.6956	0.0000	16.5959	3.4658	0.2724	3.1543	0.0000	0.103800	54.1243	0.020000
102 GRANITE	12.9053	0.8647	0.0000	1.6210	0.3400	0.0471	3.4104	0.0265	0.011500	71.2387	0.013200
103 MCCOY CANYON	13.1131	8.4792	0.0000	13.7656	4.2618	0.2621	2.9388	0.0000	0.190900	51.1293	0.033600
104 UNTANUM	12.0550	7.8075	0.0000	14.1515	3.9633	0.2479	2.3994	0.0000	0.131100	46.2089	0.022400
105 NEPELINE SYENITE	30.8744	2.8544	0.3360	0.3023	0.0332	0.0205	12.9138	0.0136	0.000000	47.9203	0.000000
106 P-16F	16.2000	15.8000	1.5000	1.5000	3.2500	0.0000	4.9800	0.0000	0.000000	53.0000	0.000000
107 P-1	12.2000	5.2000	4.1000	3.7000	0.0000	2.2000	18.0000	0.0000	0.600000	52.3000	0.000000
108 P-3	8.4000	4.6000	5.4000	4.8000	0.0000	2.3000	16.0000	0.0000	1.300000	49.2000	0.000000

Q Glass	12 B203	13 U02	14 SrO	15 ZrO2	16 TiO2	17 K2O	18 Ca2O	19 Sb2O3	20 P2O5	21 Nd2O3
55 ESF148	0.0000	0.000000	0.000000	0.000000	0.0000	14.600000	0.000000	0.0000	0.000000	0.000000
56 ESF149	0.0000	0.000000	0.000000	0.000000	0.2000	14.300000	0.000000	0.0000	0.000000	0.000000
57 ESF150	0.0000	0.000000	0.000000	0.200000	0.6000	1.500000	0.000000	0.0000	0.000000	0.000000
58 ESF159	0.0000	0.000000	0.000000	0.000000	0.5000	14.500000	0.000000	0.0000	0.000000	0.000000
59 A&T	0.0076	0.000000	0.000000	0.040500	0.7840	2.336900	0.000000	0.0000	0.000000	0.000000
60 CORNING	0.0000	0.000000	0.000000	0.000000	0.1835	1.831000	0.000000	0.0000	0.000000	0.000000
61 OBSIDIAN	0.0322	0.000000	0.000000	0.054000	0.8674	5.071400	0.000000	0.0000	0.000000	0.000000
62 CORNING	0.0000	0.000000	0.000000	0.000000	0.1835	1.831000	0.000000	0.0000	0.000000	0.000000
63 RRL2-3134	0.0000	0.000000	0.000000	0.000000	2.5620	2.300000	0.000000	0.0000	0.875200	0.000000
64 OBSIDIAN	0.0322	0.000000	0.000000	0.054000	0.8674	5.071400	0.000000	0.0000	0.000000	0.000000
65 GUJ	0.0034	0.000000	0.010600	0.000000	0.0874	0.770900	0.000000	0.0000	0.000000	0.000000
66 GQ7	0.0000	0.000000	0.011400	0.000000	1.1276	0.000000	0.000000	0.0000	0.000000	0.000000
67 GQ9	0.0576	0.000000	0.005000	0.000000	1.1309	0.000000	0.000000	0.0000	0.000000	0.000000
68 QGN	0.0000	0.000000	0.000000	0.000000	1.0191	1.000000	0.000000	0.0000	0.000000	0.000000
69 DQH	0.0000	0.000000	0.000000	0.000000	0.0193	1.000000	0.000000	0.0000	0.000000	0.000000
70 DQF	0.0000	0.000000	0.023700	0.010800	0.0150	0.403000	0.000000	0.0000	0.000000	0.000000
71 GRF	0.0000	0.000000	0.009500	0.039000	10.4417	0.072300	0.000000	0.0000	0.000000	0.000000
72 SILICA GLASS	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
73 SILICA GLASS	0.7761	0.000000	0.005500	0.002700	0.0075	0.000000	0.000000	0.0000	0.020100	0.000000
74 PYREX 7740	13.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
75 PYREX CMJ	13.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
76 WINDOW	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
77 PB GLASS	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
78 NBS	16.8500	0.000000	0.000000	0.000000	0.0000	7.150000	0.000000	0.0000	0.000000	0.000000
79 LIBYAN DESERT	0.0044	0.000000	0.000000	0.040500	0.2002	0.012000	0.000000	0.0000	0.000000	0.000000
80 CUA	3.4500	1.100000	0.100000	0.000000	0.1000	0.000000	0.150000	0.0000	0.000000	0.740000
81 FRIT 131	14.7000	0.000000	0.000000	0.500000	1.0000	0.000000	0.000000	0.0000	0.000000	0.500000
82 FRIT21	9.4000	0.000000	0.000000	0.000000	9.7000	0.000000	0.000000	0.0000	0.000000	0.000000
83 FRIT211	11.1000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
84 FRIT153	10.0000	0.000000	0.000000	1.000000	2.0000	0.000000	0.000000	0.0000	0.000000	0.000000
85 FRIT S16	0.0000	0.000000	0.000000	1.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
86 FRIT 188A	18.5000	0.000000	0.000000	0.830000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
87 FRIT S12	20.0000	0.000000	0.000000	1.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
88 FRIT S2	20.0000	0.000000	0.000000	1.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
89 FRIT166	10.0000	0.000000	0.000000	1.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
90 FRIT 168	17.0000	0.000000	0.000000	1.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
91 FRIT 165	10.0000	0.000000	0.000000	1.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
92 FRIT S17	0.5000	0.000000	0.000000	1.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
93 UNTANUM	0.0393	0.000000	0.034300	0.021000	2.1017	0.433700	0.000000	0.0000	0.000000	0.000000
94 LLNLS29	0.0000	0.000000	0.220000	3.500000	4.4500	0.000000	1.370000	0.0000	0.000000	0.000000
95 BGC-50	0.0000	0.000000	0.000000	0.000000	3.0000	0.000000	0.000000	0.0000	2.000000	0.000000
96 HANFORD BASALT	0.0000	0.000000	0.240000	0.000000	1.0400	0.450000	0.000000	0.0000	0.000000	0.000000
97 SPODUMENE GL CERAM	0.0322	0.050700	0.000000	1.512000	1.4512	0.000000	0.000000	0.0000	0.000000	0.000000
98 SPODUMENE GLASS	0.0322	0.050700	0.000000	1.512000	1.4512	0.000000	0.000000	0.0000	0.000000	0.000000
99 POWONA	0.0377	0.000000	0.030000	0.000000	1.7347	0.457700	0.000000	0.0000	0.000000	0.000000
100 STRIPA GRANITE	0.0564	0.000000	0.005300	0.000000	0.0000	3.987200	0.000000	0.0000	0.000000	0.000000
101 COHASSET	0.0412	0.000000	0.038800	0.027800	2.4688	1.590100	0.000000	0.0000	0.000000	0.000000
102 GRANITE	0.0000	0.000000	0.000000	0.014000	0.0000	5.800500	0.000000	0.0000	0.000000	0.000000
103 MCCOY CANYON	0.0541	0.000000	0.003800	0.021700	2.1851	1.082200	0.000000	0.0000	0.469700	0.000000
104 UNTANUM	0.0393	0.000000	0.035500	0.021000	2.1017	0.433700	0.000000	0.0000	0.453500	0.000000
105 NEPHELINE SYENITE	0.0377	0.000000	0.013400	0.000000	0.0267	0.072300	0.000000	0.0000	0.000000	0.000000
106 P-16F	0.0000	0.000000	0.039000	0.220000	0.1100	1.670000	0.000000	0.0000	0.000000	0.000000
107 P-1	0.0000	1.530000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
108 P-3	3.0000	0.960000	0.000000	0.000000	3.0000	0.000000	0.000000	0.0000	0.000000	0.000000

0 Glass	22 BaO	23 PbO	24 ThO2	25 28-D NSi (g/m**2)	26 pH	27 St. Ghyd (KC/Mol)	28 Jantzen's St. Ghyd	29 Ghyd (KC/Mol)	30 Jantzen's Ghyd
55 ESF148	0.0000	0.9000	0.000000	62.900000	9.270000	-13.262515	-7.939693	-13.363847	-8.041024
56 ESF149	0.0000	0.0000	0.000000	94.200000	10.200000	-10.773079	-6.063304	-11.341459	-7.431884
57 ESF150	0.0000	0.0000	0.000000	77.220000	10.240000	-12.749528	-7.283268	-13.352733	-7.886472
58 ESF159	0.0000	0.5000	0.000000	97.000000	10.600000	-21.645124	-10.706229	-22.615081	-11.678188
59 A&T	0.0000	0.0000	0.000000	1.900000	6.520000	1.065086	0.007260	1.063575	0.905770
60 CORNING	0.0000	0.0000	0.000000	1.700000	4.700000	1.158271	1.005802	1.158268	1.005799
61 OBSIDIAN	0.0447	0.0000	0.000000	1.210000	6.200000	1.216744	1.060767	1.216030	1.060053
62 CORNING	0.0000	0.0000	0.000000	2.270000	8.280000	1.158271	1.005802	1.147088	0.994619
63 RRL2-3134	0.0000	0.0000	0.000000	4.030000	8.280000	-1.091749	-0.871259	-1.102932	-0.882442
64 OBSIDIAN	0.0000	0.0000	0.000000	1.210000	7.500000	1.122403	0.973323	1.108284	0.959203
65 GQU	0.0000	0.0227	0.000000	5.220000	9.330000	-7.093426	-4.388265	-7.730266	-5.025105
66 GQT	0.0000	0.0000	0.000000	6.920000	9.410000	-7.168616	-4.498418	-7.304344	-4.632246
67 GQQ	0.0000	0.3438	0.000000	2.560500	7.020000	-9.948415	-5.628952	-9.977626	-5.658183
68 GQN	0.0000	0.1390	0.000000	3.633691	8.200000	0.119195	0.095824	0.109879	0.086508
69 DQH	0.0000	0.0000	0.000000	6.118597	8.600000	0.583137	0.479456	0.560002	0.456321
70 DQF	0.0000	0.0754	0.000000	3.394582	8.560000	1.316128	1.144866	1.295487	1.124265
71 GRF	0.0000	0.0000	0.000000	8.902404	9.220000	-6.078637	-3.743728	-6.169735	-3.834828
72 SILICA	0.0000	0.0000	0.000000	0.280000	5.150000	5.590000	5.590000	5.589992	5.589992
73 SILICA GLASS	0.0000	0.0452	0.000000	0.150000	7.600000	5.060146	4.961553	5.042413	4.943819
74 PYREX 7740	0.0000	0.0000	0.000000	0.730000	3.700000	2.265034	2.174742	2.265032	2.174740
75 PYREX CMJ	0.0000	0.0000	0.000000	1.290000	7.100000	2.265034	2.174742	2.259382	2.169090
76 WINDOW	0.0000	0.0000	0.000000	3.640000	7.790000	-5.921104	-4.162166	-5.924748	-4.165808
77 PB GLASS	0.0000	13.2498	0.000000	2.470000	7.010000	-5.463460	-3.751038	-5.464058	-3.751644
78 NBS	0.2700	0.0900	0.000000	3.200000	7.580000	-1.254747	-1.140147	-1.271691	-1.157092
79 LIBYAN DESSERT	0.0000	0.0000	0.000000	0.880000	8.500000	4.874989	4.716810	4.744140	4.585980
80 CUA	0.0000	0.0000	0.000000	1.600000	7.000000	-0.365708	-0.286714	-0.360201	-0.291207
81 FRIT 131	0.0000	0.0000	0.000000	556.000000	11.000000	-10.589072	-7.323718	-14.720693	-11.464338
82 FRIT21	0.0000	0.0000	0.000000	97.800000	10.300000	-8.951509	-6.112249	-11.182429	-8.343168
83 FRIT211	0.0000	0.0000	0.000000	50.230000	10.300000	-12.333998	-8.152275	-14.564918	-10.383195
84 FRIT153	0.0000	0.0000	0.000000	78.960000	9.600000	-5.607993	-4.210321	-6.671280	-5.173608
85 FRIT S15	0.0000	0.0000	0.000000	70.229000	12.200000	-9.492505	-6.196189	-13.062340	-9.766024
86 FRIT 168A	0.0000	0.0000	0.000000	308.412200	10.430000	-7.933625	-5.835387	-10.459312	-8.361074
87 FRIT S12	0.0000	0.0000	0.000000	15.825000	9.500000	-10.359977	-7.126892	-11.191616	-7.958332
88 FRIT S2	0.0000	0.0000	0.000000	38.600000	9.500000	-5.774321	-4.614065	-6.805981	-5.445704
89 FRIT166	0.0000	0.0000	0.000000	62.720000	9.850000	-7.147972	-5.202387	-8.496154	-6.550570
90 FRIT 168	0.0000	0.0000	0.000000	580.381800	11.460000	-7.620922	-5.655396	-12.925406	-10.959880
91 FRIT 165	0.0000	0.0000	0.000000	215.511900	10.460000	-7.147972	-5.202387	-8.743856	-7.798272
92 FRIT S17	0.0000	0.0000	0.000000	154.352900	10.500000	-7.812868	-5.587532	-10.503543	-8.278209
93 UMTANUM	0.0000	0.3092	0.000000	9.250000	7.810000	-7.489548	-4.782039	-7.518106	-4.790598
94 LLNLS29	0.0000	0.0000	0.000000	9.380000	6.500000	-5.532689	-3.771058	-5.532676	-3.771245
95 BGC-50	0.0000	0.0000	0.000000	8.400000	7.160000	-2.541717	-1.984655	-2.542572	-1.985511
96 HANFORD BASALT	0.0000	0.0000	0.000000	6.300000	7.110000	-7.550832	-4.802716	-7.551595	-4.803479
97 SPODUMENE GL CERAM	0.0000	0.0000	0.000000	1.800000	8.300000	2.429399	2.155456	2.344336	2.070393
98 SPODUMENE GLASS	0.0000	0.0000	0.000000	1.850000	8.300000	2.429399	2.155456	2.344336	2.070393
99 POMONA	0.0274	0.0388	0.000000	8.220000	7.890000	-6.924387	-4.386273	-6.946147	-4.408033
100 STRIPA GRANITE	0.0424	0.0992	0.000000	1.290000	7.360000	1.386565	1.241165	1.378311	1.230911
101 COHASSET	0.0000	0.3438	0.000000	6.800000	7.460000	-5.728911	-3.822331	-5.741798	-3.835219
102 GRANITE	0.0000	0.0000	0.000000	0.980000	8.050000	0.893963	0.793896	0.887353	0.787086
103 MCCOY CANYON	0.0000	0.0000	0.000000	5.570000	7.730000	-6.043907	-4.006887	-6.067736	-4.030514
104 UMTANUM	0.0000	0.0000	0.000000	6.030000	7.710000	-6.177122	-4.045074	-6.199892	-4.067844
105 NEPHELINE SYENITE	0.0000	0.0000	0.000000	4.510000	8.360000	-2.738985	-2.207037	-2.835899	-2.303951
106 P-16F	0.0000	0.0000	0.000000	5.790000	8.500000	-5.686476	-3.910881	-5.704924	-3.929329
107 P-1	0.0000	0.0000	0.000000	11.493300	9.970000	-8.077455	-5.518326	-8.470653	-5.911524
108 P-3	0.0000	0.0000	0.000000	11.153300	9.800000	-7.379677	-5.095794	-8.644552	-8.300689

Ø Glass	31 N80	32 Val. Par.	33
56 ESF148	0.750582	-0.753456	4.141548
58 ESF149	0.679223	-0.762396	4.545420
57 ESF150	0.807307	-0.749602	4.346658
58 ESF159	0.977206	-0.742181	4.574711
59 A&T	0.163970	-0.927233	0.641854
60 CORNING	0.116588	-0.880571	0.530628
61 OBSIDIAN	0.287613	-0.883912	0.190620
62 CORNING	0.116588	-0.880571	0.819780
63 RRL2-3134	0.315315	-0.892400	1.393766
64 OBSIDIAN	0.298594	-0.884158	0.190620
66 GQU	0.822867	-0.964072	1.652497
66 GQT	0.619797	-0.976793	1.778336
67 GQQ	0.748442	-0.989157	0.942543
68 GQN	0.264760	-0.971988	1.290249
69 DQH	0.057189	-0.950078	1.632880
70 DQF	0.071047	-0.864521	1.222181
71 GRF	0.996795	-0.989647	2.186321
72 SILICA	0.000000	-1.000000	-1.347074
73 SILICA GLASS	0.035999	-0.999363	-1.897120
74 PYREX 7740	0.055495	-0.908443	-0.314711
75 PYREX CMJ	0.055495	-0.908443	0.254642
76 WINDOW	0.588298	-0.887584	1.291984
77 PB GLASS	0.484336	-0.495531	0.904218
78 NBS	0.135787	-0.781296	1.163151
79 LIBYAN DESSERT	0.073045	-0.989344	-0.127833
80 CUA	0.228889	-0.943242	0.518794
81 FRIT 131	0.655776	-0.235025	6.318968
82 FRIT21	0.927755	-0.367072	4.582925
83 FRIT211	0.678081	-0.238695	3.916612
84 FRIT153	0.566506	-0.457098	4.368941
85 FRIT S15	0.702997	-0.203282	4.251761
86 FRIT 168A	0.519821	-0.351867	5.731437
87 FRIT S12	0.632871	-0.149440	2.761591
88 FRIT S2	0.411954	-0.501131	3.653252
89 FRIT165	0.553637	-0.353783	4.138680
90 FRIT 168	0.525263	-0.347100	6.328618
91 FRIT 165	0.553637	-0.353783	5.373016
92 FRIT S17	0.578872	-0.319707	5.039242
93 UMTANUM	0.837938	-0.867141	2.225704
94 LLNLS29	0.438882	-0.683840	2.238580
95 BGC-50	0.336299	-0.791867	-0.174353
96 HANFORD BASALT	0.609436	-0.872459	1.840550
97 SPODUMENE GL CERAM	0.008956	-0.815098	0.587787
98 SPODUMENE GLASS	0.008956	-0.815098	0.615186
99 POMONA	0.615771	-0.949281	2.106570
100 STRIPA GRANITE	0.033892	-0.852952	0.254642
101 COHASSET	0.582127	-0.902476	1.918923
102 GRANITE	0.053861	-0.837605	-0.020203
103 MCCOY CANYON	0.578329	-0.911478	1.717395
104 UMTANUM	0.697512	-0.929152	1.796747
105 NEPHELINE SYENITE	-0.055965	-0.898057	1.608297
106 P-16F	0.412367	-0.855596	1.756132
107 P-1	0.454401	-0.563586	2.441784
108 P-3	0.572903	-0.591095	2.411735

0 Glass	1 Al2O3	2 CaO	3 Fe2O3	4 FeO	5 MgO	6 MnO	7 Na2O	8 Li2O	9 NiO	10 SiO2	11 Cr2O3
109 P-40	5.7000	7.2000	10.8400	2.9300	0.8000	2.8000	10.0000	0.0000	0.000000	55.8000	0.300000
110 AY	1.3415	12.9426	1.2095	0.0000	2.2387	0.0439	13.4935	0.0000	0.003800	66.6178	0.000000
111 AX	1.5040	21.2678	1.2024	0.0000	2.4045	0.9878	2.0286	0.1162	0.000000	64.3929	0.000000
112 JQQ	1.1186	15.3212	1.3325	0.0000	6.0694	0.9428	2.0900	0.0431	0.031800	55.1298	0.021900
113 JQR	1.8895	16.2307	1.1152	0.0000	2.5040	0.9038	1.4289	0.0431	0.000000	55.5000	0.000000
114 AV	1.2622	2.3926	0.1658	0.0000	1.0563	0.0000	0.2858	0.0215	0.000000	74.4478	0.000000
115 19K	0.0000	9.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000000	67.0000	0.000000
116 19M	0.2324	9.5491	0.0000	0.0000	0.0663	1.7560	0.1483	0.0215	0.000000	53.5487	0.000000
117 19L	0.0000	8.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.000000	58.0000	0.000000
118 1825 ACT	1.1337	6.8561	0.7006	0.0000	4.8091	0.4132	11.0266	0.0215	0.000000	71.4954	0.000000
119 835ACTUAL	3.2122	11.8932	0.1830	0.0000	0.6633	0.5036	14.2888	0.0215	0.022900	66.5322	0.022700
120 842ACTUAL	2.8531	9.3886	0.4947	0.0000	0.6119	0.3744	11.7278	0.0431	0.027200	73.4288	0.017200
121 1824ACT	1.3038	7.2759	0.5562	0.0000	5.1407	0.2970	9.7865	0.0431	0.024200	69.5273	0.017500
122 EZI	2.6340	10.4156	1.8872	0.0000	1.0033	0.9684	16.0000	0.0000	0.018800	62.0397	0.018400
123 AAX	2.6642	7.8215	0.5805	0.0000	0.9452	0.3460	17.1196	0.0000	0.000000	67.0000	0.000000
124 DGH	2.7587	6.6462	0.3531	0.0000	1.5273	0.0052	11.8759	0.0431	0.012700	74.8755	0.010200
125 JXU	1.2490	1.6650	0.1916	0.0000	0.0531	0.0052	0.2686	0.0000	0.025500	72.4966	0.014600
126 TWB	0.3949	0.4282	1.4154	0.0000	0.0356	0.0000	3.2062	0.0000	0.257100	37.0099	0.239700
127 DA	2.1162	4.2256	0.3288	0.0000	0.5572	0.0000	20.5000	0.0000	0.000000	69.0994	0.000000
128 DC	2.0596	2.0568	0.5862	0.0000	0.4942	0.0000	2.4936	0.0000	0.000000	42.0000	0.000000
129 DD	2.0000	1.0000	0.4000	0.0000	0.3000	0.0000	1.0000	0.0000	0.000000	19.7000	0.000000
130 DB	2.0000	3.0000	0.4000	0.0000	1.0000	0.0000	3.0000	0.0000	0.000000	63.5000	0.000000
131 DE	1.5000	1.0000	0.2000	0.0000	0.5000	0.0000	14.5000	0.0000	0.000000	66.0000	0.000000
132 DGW	3.1177	18.5954	1.7156	0.0000	2.9884	0.6843	1.7928	0.0215	0.012700	59.5000	0.014600
133 SCU	1.3397	10.4450	0.7177	0.0000	1.3747	0.0220	2.2242	0.0215	0.192200	73.2710	0.002100
134 UK	0.1588	10.9278	0.3217	0.0000	0.0497	0.0000	18.0000	0.0448	0.000000	59.8000	0.009200
135 EZA	4.2325	19.5888	0.1473	0.0000	1.7578	0.0000	20.0000	0.0861	0.000000	47.8000	0.000000
136 19AF	0.3552	12.6208	0.1487	0.0000	0.0778	0.0000	2.1433	0.0560	0.000000	67.6019	0.000000
137 EZB	3.0988	12.2150	0.1515	0.0000	7.6282	0.0123	9.8000	0.1292	0.018500	49.4178	0.000000
138 Ezc	2.2107	6.4643	0.0000	0.0000	10.1985	0.0000	4.3136	0.0000	0.000000	51.5571	0.000000
139 19AG	0.0504	12.2710	0.1221	0.0000	0.0720	0.0000	2.8038	0.0215	0.000000	64.8208	0.000000
140 19AE	0.2381	11.1936	0.2059	0.0000	0.0531	0.0000	3.4104	0.0431	0.022900	72.2014	0.000000
141 DYS	0.2645	8.4931	0.0000	0.0000	0.0846	0.0000	8.0476	0.0215	0.000000	66.4467	0.000000
142 19AH	0.0000	11.3000	0.0000	0.0000	0.0000	0.0000	3.8000	0.0000	0.000000	67.6000	0.000000
143 GPX	0.2475	10.6199	0.2731	0.0000	0.0580	0.0000	20.0000	0.0646	0.008900	69.9551	0.000000
144 GPX-DUP	0.2475	10.6199	0.2731	0.0000	0.0580	0.0000	20.0000	0.0646	0.008900	69.9551	0.000000
145 X	0.2626	8.7086	0.2273	0.0000	0.0514	0.0000	16.0000	0.0000	0.000000	62.9188	0.000000
146 DTJ	0.2967	0.4701	0.2430	0.0000	0.0000	0.0000	20.0852	0.0000	0.000000	23.3184	0.000000
147 DTK	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	21.0000	0.0000	0.000000	32.0000	0.000000
148 EZT	2.3808	8.7730	1.1000	0.0000	2.5040	1.2000	16.9000	0.0431	0.000000	66.2000	0.000000
149 DF	1.5000	1.0000	0.5000	0.0000	0.0000	0.0000	1.0000	0.0000	0.000000	30.5000	0.000000
150 zr1a	3.9000	2.9400	10.3000	0.0000	0.8600	0.0000	10.2000	4.0000	0.550000	52.5000	1.240000
151 zr2a	2.7000	3.1000	6.8000	0.0000	0.8400	0.0000	10.3000	4.3000	0.365000	57.2000	0.800000
152 zr3a	0.0000	3.1000	0.0000	0.0000	0.8600	0.0000	6.6000	4.3000	0.000000	57.1000	0.000000
153 zr4a	1.3000	2.8000	3.6000	0.0000	0.7200	0.0000	8.7000	4.0000	0.180000	52.3000	0.390000
154 zr5a	2.7000	2.6200	6.8000	0.0000	0.7400	0.0000	8.7000	3.6000	0.360000	47.8000	0.810000
155 ZR6A	5.3000	2.8000	13.6000	0.0000	0.8000	0.0000	10.3000	3.5000	0.720000	48.3000	1.600000
156 ZR7A	0.0000	3.1000	0.0000	0.0000	0.8300	0.0000	8.6000	4.3000	0.000000	57.0000	0.000000
157 ZR8A	5.2000	2.7000	13.9000	0.0000	0.7500	0.0000	10.4000	3.6000	0.730000	48.3000	1.720000
158 ZR9A	2.5000	3.1000	6.9000	0.0000	0.8400	0.0000	10.4000	4.3000	0.360000	57.3000	0.790000
159 ZR10A	1.2000	3.2000	3.5000	0.0000	0.7700	0.0000	9.5000	4.3000	0.180000	56.3000	0.390000
160 ZR11A	4.9000	2.5000	10.0000	0.0000	0.6800	0.0000	9.5000	3.4000	0.550000	49.7000	1.100000
161 ZR12A	2.5000	2.9000	7.0000	0.0000	0.7300	0.0000	9.5000	4.0000	0.360000	52.8000	0.790000
162 HWMAS1	4.4000	2.8000	10.7000	0.0000	0.7600	0.0000	16.8000	0.0000	0.570000	48.8000	1.280000

0 Glass	12 B203	13 U02	14 Sr0	15 Zr02	16 Ti02	17 K20	18 Cs20	19 Sb203	20 P205	21 Nd203
109 P-40	0.0000	1.300000	0.100000	0.000000	0.0000	0.000000	0.100000	0.0000	0.000000	0.700000
110 AY	0.0000	0.000000	0.057000	0.000000	0.0000	1.927400	0.000000	0.0000	0.000000	0.000000
111 AX	0.0000	0.000000	0.000000	0.000000	0.0000	9.624600	0.000000	0.0000	0.000000	0.000000
112 JQQ	0.0000	0.000000	0.011800	0.000000	0.0133	7.059000	0.000000	0.0000	3.826000	0.000000
113 JQR	0.0000	0.000000	0.050900	0.000000	0.0000	18.500000	0.000000	0.0000	1.024100	0.000000
114 AV	0.0000	0.000000	0.000000	0.000000	0.0000	20.000000	0.000000	0.0000	0.000000	0.000000
115 19K	0.0000	0.000000	0.000000	0.000000	0.0000	14.000000	0.000000	0.0000	0.000000	0.000000
116 19M	0.0000	0.000000	0.010600	0.000000	0.0000	11.000000	0.000000	0.0000	0.000000	0.000000
117 19L	0.0000	0.000000	0.000000	0.000000	0.0000	11.000000	0.000000	0.0000	0.000000	0.000000
118 1825 ACT	0.0644	0.000000	0.000000	0.000000	0.0334	2.168300	0.000000	0.0000	0.091600	0.000000
119 835ACTUAL	0.0000	0.000000	0.118300	0.010600	0.0150	3.963100	0.000000	0.0000	0.042200	0.000000
120 842ACTUAL	0.0332	0.000000	0.060300	0.002200	0.0612	0.770900	0.000000	0.0083	0.146600	0.000000
121 1824ACT	0.1288	0.000000	0.047300	0.012200	0.0584	2.349000	0.000000	0.0000	0.114600	0.000000
122 EZI	0.0000	0.000000	0.010600	0.000000	0.0150	0.963700	0.000000	0.0000	0.000000	0.000000
123 AAX	0.0515	0.000000	0.000000	0.000000	0.0000	1.000000	0.000000	1.5000	0.000000	0.000000
124 DGH	0.0000	0.000000	0.000300	0.000000	0.0000	1.000000	0.000000	0.2753	0.000000	0.000000
125 JXU	0.0000	0.000000	0.007100	0.009500	0.0183	20.000000	0.000000	0.0000	0.151200	0.000000
126 TWB	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
127 DA	0.0000	0.000000	0.000000	0.000000	0.0000	0.500000	0.000000	0.0000	0.000000	0.000000
128 DC	0.0000	0.000000	0.000000	0.000000	0.0000	0.614300	0.000000	0.0000	0.000000	0.000000
129 DD	0.0000	0.000000	0.000000	0.000000	0.0000	0.500000	0.000000	0.0000	0.000000	0.000000
130 DB	0.0000	0.000000	0.000000	0.000000	0.0000	2.000000	0.000000	0.0000	0.000000	0.000000
131 DE	0.0000	0.000000	0.000000	0.000000	0.0000	1.000000	0.000000	0.0000	0.000000	0.000000
132 DGW	0.0000	0.000000	0.011800	0.000000	0.0000	10.000000	0.000000	0.0000	0.000000	0.000000
133 SCU	0.0000	0.000000	0.255400	0.243100	0.2218	10.492100	0.000000	0.0000	0.000000	0.000000
134 UK	0.0000	0.000000	0.008300	0.000000	0.0634	0.000000	0.159000	10.0000	0.000000	0.000000
135 EZA	0.0000	0.000000	0.000000	0.000000	0.0000	6.312100	0.000000	0.1000	0.000000	0.000000
136 19AF	0.0000	0.000000	0.000000	0.000000	0.0000	0.384000	0.000000	0.0000	0.000000	6.000000
137 EZB	0.0000	0.000000	0.000000	0.000000	0.0000	15.200000	0.000000	2.0000	0.000000	0.000000
138 EZC	0.0000	0.000000	0.000000	0.000000	0.0000	23.800000	0.000000	3.2000	0.000000	0.000000
139 19AG	0.0000	0.000000	0.000000	0.000000	0.0000	11.300000	0.000000	0.0000	0.000000	8.000000
140 19AE	0.0000	0.000000	0.000000	0.000000	0.0000	12.000000	0.000000	0.0000	0.000000	0.000000
141 DYS	13.2990	0.000000	0.000000	0.000000	0.0000	1.915300	0.000000	0.0000	0.000000	0.000000
142 19AH	0.0000	0.000000	0.000000	0.000000	0.0000	11.300000	0.000000	0.0000	0.000000	8.000000
143 GPX	0.0000	0.000000	0.008300	0.000000	0.0000	0.036100	0.000000	0.0000	0.000000	0.000000
144 GPX-DUP	0.0000	0.000000	0.008300	0.000000	0.0000	0.036100	0.000000	0.0000	0.000000	0.000000
145 X	9.7247	0.000000	0.007100	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
146 DTJ	50.5556	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
147 DTK	47.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
148 EZT	0.0000	0.000000	0.000000	0.000000	0.0000	2.000000	0.000000	0.0000	0.000000	0.000000
149 DF	0.0000	0.000000	0.000000	0.000000	0.0000	0.500000	0.000000	0.0000	0.000000	0.000000
150 zr1a	9.9000	0.000000	0.000000	0.000000	0.0000	0.000000	0.160000	0.0000	0.010000	0.430000
151 zr2a	10.9000	0.000000	0.050000	0.000000	0.0010	0.000000	0.103000	0.0000	0.010000	0.270000
152 zr3a	10.8000	0.000000	0.000000	15.700000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
153 zr4a	9.8000	0.000000	0.030000	15.700000	0.0000	0.000000	0.050000	0.0000	0.000000	0.130000
154 zr5a	9.1000	0.000000	0.050000	15.700000	0.0000	0.000000	0.100000	0.0000	0.010000	0.270000
155 ZR6A	9.0000	0.000000	0.100000	0.000000	0.0020	0.000000	0.206000	0.0000	0.020000	0.570000
156 ZR7A	10.8000	0.000000	0.000000	15.800000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
157 ZR8A	8.8000	0.000000	0.100000	0.000000	0.0000	0.000000	0.210000	0.0000	0.020000	0.580000
158 ZR9A	10.7000	0.000000	0.050000	0.000000	0.0000	0.000000	0.100000	0.0000	0.010000	0.280000
159 ZR10A	10.7000	0.000000	0.030000	7.900000	0.0000	0.000000	0.050000	0.0000	0.000000	0.150000
160 ZR11A	8.2000	0.000000	0.070000	7.500000	0.0000	0.000000	0.150000	0.0000	0.010000	0.380000
161 ZR12A	9.8000	0.000000	0.060000	7.900000	0.0000	0.000000	0.100000	0.0000	0.010000	0.270000
162 HWMAS1	9.3000	0.000000	0.080000	0.700000	0.0300	0.040000	0.160000	0.0000	0.200000	0.410000

0 Glass	22 BaO	23 PbO	24 ThO2	25 28-O NSi (g/m ²)	26 pH	27 St. Ghyl (KC/Mol)	28 Jantzen's St. Ghyl	29 Ghyl (KC/Mol)	30 Jantzen's Ghyl
109 P-40	0.0000	0.0000	0.000000	9.680000	8.000000	-4.054377	-2.933369	-4.000272	-2.939264
110 AY	0.0000	0.0000	0.000000	22.260000	9.820000	-7.511939	-5.087008	-7.813990	-5.389080
111 AX	0.0000	0.0000	0.000000	17.040000	10.450000	-9.077694	-5.857982	-9.883742	-6.664010
112 JQQ	0.0000	0.1691	0.000000	25.922690	9.800000	-10.773451	-6.822932	-11.004086	-7.114189
113 JQR	0.0000	0.0000	0.000000	20.580000	9.920000	-13.544515	-8.400557	-13.005333	-8.781375
114 AV	0.0000	0.0000	0.000000	21.322720	10.540000	-3.738994	-3.042915	-4.641612	-3.945533
115 19K	0.0000	10.0000	0.000000	4.831187	9.250000	-4.419860	-3.355041	-4.516978	-3.452157
116 19M	0.0000	25.0000	0.000000	5.873427	9.100000	-6.831498	-4.679657	-6.901824	-4.749984
117 19L	0.0000	25.0000	0.000000	2.012936	8.710000	-5.392125	-3.855588	-5.421767	-3.685210
118 1825 ACT	0.0000	0.0323	0.000000	28.908050	9.500000	-4.648834	-3.388329	-5.480473	-4.219968
119 835ACTUAL	0.0000	0.0517	0.000000	11.994070	9.800000	-7.677140	-5.302712	-7.908384	-5.593948
120 842ACTUAL	0.0170	0.0520	0.000000	11.291260	9.910000	-3.255421	-2.486814	-4.707672	-3.939065
121 1824ACT	0.0000	0.0797	0.000000	27.695530	9.800000	-4.711383	-3.414802	-5.674670	-4.377890
122 EZI	0.0000	0.0183	0.000000	14.310940	9.980000	-8.068095	-5.488050	-8.468013	-6.867960
123 AAX	0.0000	0.0000	0.000000	14.017790	9.400000	-6.280893	-4.502192	-8.993571	-5.214871
124 DGH	0.0000	0.0000	0.000000	9.708100	9.630000	-2.638803	-2.057798	-2.850028	-3.885203
125 JXU	0.0000	3.0000	0.000000	41.019170	11.970000	-3.534714	-2.911070	-6.619510	-5.995865
126 TWB	11.7233	45.0000	0.000000	4.710000	8.640000	-6.424391	-4.165439	-6.440711	-4.190760
127 DA	0.0000	0.6788	0.000000	190.100000	11.500000	-6.015942	-4.406762	-8.240704	-6.631524
128 DC	20.0000	30.0000	0.000000	2.380000	8.320000	-7.406384	-4.941709	-7.418636	-4.953960
129 DD	30.0000	45.0000	0.000000	8.890000	8.070000	-26.814792	-11.820201	-28.821712	-11.827121
130 DB	10.0000	15.0000	0.000000	0.860000	8.280000	-1.514597	-1.202212	-1.525780	-1.213396
131 DE	0.0000	15.2000	0.000000	5.870000	10.330000	-3.550135	-2.714793	-4.200906	-3.400906
132 DGW	0.0000	0.1185	0.000000	12.746440	10.040000	-8.805272	-5.738013	-9.247219	-6.179980
133 SCU	0.1865	0.0000	0.000000	12.310000	10.000000	-3.515909	-2.696331	-3.929510	-3.109931
134 UK	0.0000	0.0000	0.000000	31.590000	10.540000	-8.419709	-5.717560	-9.322327	-6.620178
135 EZA	0.0000	0.0000	0.000000	18.530000	10.510000	-21.708421	-11.207363	-22.578244	-12.077186
136 19AF	0.0000	0.0000	0.000000	35.440000	10.200000	-3.981271	-3.045710	-4.549650	-3.614090
137 EZB	0.0000	0.0000	0.000000	25.150000	10.880000	-19.654646	-10.626187	-20.717875	-11.689396
138 EZC	0.0000	0.0000	0.000000	34.030000	11.000000	-18.993044	-10.699368	-20.466333	-12.172057
139 19AG	0.0000	0.0000	0.000000	38.010000	10.050000	-5.919407	-4.378123	-6.368046	-4.827382
140 19AE	0.0000	0.0000	0.000000	28.167050	10.050000	-4.831842	-3.510171	-5.080891	-3.959410
141 DYS	0.0000	0.5171	0.000000	59.113850	9.320000	-3.477114	-2.813064	-4.103013	-3.439563
142 19AH	0.0000	0.0000	0.000000	34.854300	10.070000	-5.578549	-4.178990	-6.042818	-4.843056
143 GPX	0.0000	0.0000	0.000000	105.050200	11.260000	-7.516783	-5.213341	-9.382590	-7.059148
144 GPX-DUP	0.0000	0.0000	0.000000	52.601570	9.920000	-7.516783	-5.213341	-7.877601	-5.574159
145 X	0.0000	0.0000	0.000000	43.524410	9.710000	-6.535880	-4.847420	-7.058738	-5.970278
146 DTJ	0.0000	0.0000	0.000000	248.800800	9.180000	-14.606728	-11.280395	-15.084018	-11.737683
147 DTK	0.0000	0.0000	0.000000	108.310000	9.200000	-12.738386	-9.947509	-13.250180	-10.459283
148 EZT	0.0000	0.0000	0.000000	16.130000	9.550000	-7.987489	-5.437669	-8.167911	-5.618110
149 DF	0.0000	64.0000	0.000000	1.470000	8.500000	-4.551721	-2.008910	-4.750170	-2.827358
150 zr1a	0.0918	0.0000	0.000000	13.000000	9.700000	-5.850064	-4.222398	-6.757777	-5.330109
151 zr2a	0.0520	0.0000	0.000000	15.000000	9.700000	-5.800257	-4.358517	-6.907989	-5.484230
152 zr3a	0.0000	0.0000	0.000000	12.000000	9.700000	-1.502150	-1.042958	-2.609863	-2.150671
153 zr4a	0.0300	0.0000	0.000000	7.000000	9.300000	-1.097484	-0.756747	-1.703684	-1.362927
154 zr5a	0.0500	0.0000	0.000000	8.000000	9.500000	-0.678924	-0.464962	-1.510563	-1.208601
155 ZR6A	0.1100	0.0000	0.000000	13.000000	9.700000	-5.250255	-3.939951	-6.363968	-5.047684
156 ZR7A	0.0000	0.0000	0.000000	12.000000	9.700000	-1.470062	-1.020581	-2.578375	-2.128294
157 ZR8A	0.1300	0.0000	0.000000	13.000000	9.700000	-5.343075	-3.998289	-6.450788	-5.096002
158 ZR9A	0.0600	0.0000	0.000000	15.000000	9.800000	-5.827745	-4.370363	-7.092620	-5.635238
159 ZR10A	0.0400	0.0000	0.000000	12.000000	9.700000	-3.843630	-2.783565	-4.951343	-3.871278
160 ZR11A	0.0800	0.0000	0.000000	7.000000	9.400000	-2.626528	-1.912382	-3.341208	-2.625041
161 ZR12A	0.0600	0.0000	0.000000	9.000000	9.500000	-3.428551	-2.462065	-4.258190	-3.293704
162 HWMAS1	0.1000	0.0000	0.000000	12.790000	9.140000	-6.220909	-4.634080	-6.681636	-5.094808

Ø Glass	31 NBO	32 Val. Par.	33
109 P-40	0.413492	-0.755758	2.267994
110 AY	0.620761	-0.661936	3.102791
111 AX	0.683087	-0.788789	2.835584
112 JQQ	0.709010	-0.814635	3.255119
113 JQR	0.726471	-0.852930	3.024320
114 AV	0.354898	-0.889626	3.059773
115 19K	0.481834	-0.769954	1.575092
116 19M	0.626481	-0.782040	1.735793
117 19L	0.569928	-0.791082	0.699594
118 1825 ACT	0.524577	-0.719895	3.364051
119 835ACTUAL	0.580131	-0.813078	2.484412
120 842ACTUAL	0.436782	-0.728753	2.424029
121 1824ACT	0.532797	-0.738244	3.321307
122 EZI	0.596533	-0.578758	2.881024
123 AAX	0.548535	-0.588705	2.640327
124 DGH	0.408301	-0.723234	2.272755
125 JXU	0.335841	-0.681541	3.714040
126 TWB	0.686772	-0.871927	1.549888
127 DA	0.506474	-0.519355	5.247550
128 DC	0.621468	-0.897808	0.858682
129 DD	1.002661	-0.928447	1.930071
130 DB	0.379953	-0.886792	-0.150823
131 DE	0.448688	-0.821956	1.769855
132 DGW	0.644851	-0.795505	2.545252
133 SCU	0.453757	-0.794201	2.510412
134 UK	0.774702	-0.549074	3.452841
135 EZA	0.916467	-0.373106	2.919391
136 19AF	0.535430	-0.812011	3.587841
137 EZB	0.905197	-0.480016	3.224858
138 EZC	0.887806	-0.485386	3.527242
139 19AG	0.591136	-0.744893	3.593797
140 19AE	0.479707	-0.737286	3.338154
141 OYS	0.378724	-0.761082	4.079485
142 19AH	0.571892	-0.730102	3.545422
143 GPX	0.607988	-0.544880	4.054438
144 GPX-DUP	0.607988	-0.544880	3.982746
145 X	0.511693	-0.590406	3.773322
146 DTJ	0.452083	0.155387	5.508578
147 DTK	0.438184	-0.034678	4.684997
148 EZT	0.802080	-0.581023	2.780681
149 DF	0.723872	-0.938508	0.385282
150 zr1a	0.406746	-0.515011	2.564949
151 zr2a	0.433303	-0.507584	2.708050
152 zr3a	0.771434	-0.550371	2.484907
153 zr4a	0.753636	-0.552068	1.945910
154 zr5a	0.735809	-0.584114	2.079442
155 ZR8A	0.381785	-0.530144	2.584949
156 ZR7A	0.773314	-0.549933	2.484907
157 ZR8A	0.370565	-0.524034	2.584949
158 ZR9A	0.437122	-0.505195	2.708050
159 ZR10A	0.612337	-0.522064	2.484907
160 ZR11A	0.511124	-0.588831	1.945910
161 ZR12A	0.581079	-0.533565	2.197225
162 HWMAS1	0.405742	-0.525051	2.548884

0 Glass	1 Al2O3	2 CaO	3 Fe2O3	4 FeO	5 MgO	6 MnO	7 Na2O	8 Li2O	9 NiO	10 SiO2	11 Cr2O3
163 HWMAS2	5.0000	3.1300	11.9000	0.0000	0.8700	0.0000	0.1500	0.5000	0.630000	54.4000	1.280000
164 HWMAS3	3.9000	2.5100	9.9700	0.0000	0.6800	0.0000	0.1500	0.0000	0.520000	44.9000	1.100000
165 HWMAS4	4.1000	2.6200	10.5000	0.0000	0.7400	0.0000	5.8000	2.7000	0.570000	48.9000	1.200000
166 HWMAS5	4.1000	2.8500	10.8000	0.0000	0.7500	0.0000	8.4000	0.0000	0.550000	47.0000	1.200000
167 HWMAS6	4.2000	2.8200	10.7000	0.0000	0.7900	0.0000	0.1500	4.4000	0.570000	49.0000	1.260000
168 HWVS1	0.0000	3.0000	4.8500	0.0000	1.1000	0.0000	7.4000	3.7000	2.160000	51.0000	4.930000
169 HWVS2	3.1000	2.7800	8.6000	0.0000	0.6800	0.0000	11.2000	3.7000	0.780000	51.7000	1.730000
170 HWVS3	0.0000	2.9500	5.0000	0.0000	1.1000	0.0000	7.3000	3.7000	1.940000	50.5000	4.400000
171 HWVS4	0.0000	2.7800	14.0000	0.0000	0.8200	0.0000	7.4000	3.8000	0.320000	58.0000	0.710000
172 HWVS5	3.1000	2.8000	8.7000	0.0000	0.8400	0.0000	11.1000	3.6000	0.780000	52.0000	1.800000
173 HWVS6	8.5000	2.8000	14.5000	0.0000	0.7100	0.0000	7.4000	3.6000	0.220000	50.3000	0.450000
174 HWVS7	0.0000	2.9000	4.8000	0.0000	0.8500	0.0000	7.3000	3.6000	0.750000	55.4000	1.840000
175 HWVS8	8.3000	2.8000	5.1000	0.0000	0.7800	0.0000	10.7000	3.5000	0.000000	49.7000	0.000000
176 HWVS10	3.2000	2.8000	0.5000	0.0000	0.9500	0.0000	11.4000	3.8000	0.760000	52.2000	1.700000
177 HWVS11	5.4000	2.7100	5.1000	0.0000	0.7800	0.0000	17.6000	3.7000	0.000000	55.0000	0.040000
178 HWVS12	8.6000	2.9000	15.3000	0.0000	1.2000	0.0000	7.3000	3.4000	0.000000	51.2000	0.000000
179 HWVS13	0.0000	2.7000	15.1000	0.0000	0.7000	0.0000	17.3000	3.6000	0.000000	50.3000	0.000000
180 HWVS14	0.0000	3.0000	13.2000	0.0000	0.9300	0.0000	7.6000	3.7000	1.290000	51.4000	2.900000
181 HWVS15	0.0000	2.9600	11.2000	0.0000	0.9000	0.0000	7.6000	3.6000	1.290000	51.3000	3.000000
182 HWCRO	4.5000	2.8600	11.3000	0.0000	0.9100	0.0000	10.3000	8.8600	0.000000	52.5000	0.000000
183 HWCRI	4.5300	2.8600	11.3000	0.0000	0.8900	0.0000	10.1000	3.7800	0.590000	52.2000	0.980000
184 HWCRI34	4.5200	2.8600	11.2000	0.0000	0.8900	0.0000	10.2000	3.8400	0.590000	51.9000	1.330000
185 HWCRI2	4.4700	2.8400	11.1000	0.0000	0.9000	0.0000	10.2000	3.8100	0.590000	51.7000	2.000000
186 HWCRI5	4.4700	2.8200	11.2000	0.0000	0.9000	0.0000	10.2000	3.8700	0.590000	52.0000	0.000000
187 U308_1	4.3300	2.8700	10.9000	0.0000	0.8100	0.0000	10.7000	3.7300	0.580000	51.9000	1.210000
188 U308_2	4.2200	2.8300	10.6000	0.0000	0.8400	0.0000	10.5000	3.6800	0.570000	51.2000	1.160000
189 U308_3	4.0200	2.8500	9.9100	0.0000	0.9400	0.0000	10.3000	3.6200	0.530000	51.7000	1.140000
190 U308_4	3.7700	2.7900	8.9000	0.0000	1.0300	0.0000	10.3000	3.6000	0.490000	51.3000	1.020000
191 U308_5	3.1700	2.7900	8.0700	0.0000	0.7800	0.0000	9.6500	3.6200	0.450000	50.5000	0.920000
192 U308_6	2.8700	2.8300	7.2300	0.0000	0.7900	0.0000	9.7400	3.6100	0.400000	50.0000	0.850000
193 1-9	1.0200	0.3900	20.4300	0.0000	0.0000	0.0000	16.3600	0.0000	0.000000	61.7900	0.000000
194 2-30	3.2000	4.6200	5.9600	0.0000	0.0000	0.0000	17.3600	0.0000	0.217000	42.1200	0.458800
195 3-15	1.3400	0.3100	20.6500	0.0000	0.0000	0.0000	12.3900	0.0000	0.739200	43.9800	1.562800
196 4-44	8.7500	5.9000	7.4300	0.0000	0.0000	0.0000	18.7200	0.0000	0.259350	44.1800	0.548340
197 5-40	3.4800	5.0800	6.2000	0.0000	0.0000	0.0000	28.7300	0.0000	0.280350	42.2000	0.592740
198 6-71	12.3000	15.1600	8.9700	0.0000	0.0000	0.0000	30.0200	0.0000	0.000000	35.5500	0.000000
199 7-34	4.5100	6.2500	8.1000	0.0000	0.0000	0.0000	19.1700	0.0000	0.288050	45.3200	0.609020
200 8-62	5.6400	1.2300	11.6300	0.0000	0.0000	0.0000	16.3900	0.0000	0.000000	54.1000	0.000000
201 9-3	8.1400	0.0000	17.1900	0.0000	0.0000	0.0000	12.0000	0.0000	0.000000	62.6700	0.000000
202 10-30	0.0900	15.2700	17.0100	0.0000	0.0000	0.0000	30.0300	0.0000	0.000000	37.0000	0.000000
203 11-57	4.4000	0.2100	0.0000	0.0000	0.0000	0.0000	29.7700	0.0000	0.718550	35.9800	1.519220
204 12-65	0.7900	0.0000	10.9000	0.0000	0.0000	0.0000	15.6100	0.0000	0.000000	60.8300	0.000000
205 13-60	0.9200	2.2500	13.4800	0.0000	0.0000	0.0000	16.1300	0.0000	0.373450	47.5700	0.789580
206 14-67	0.0800	0.4000	20.6300	0.0000	0.0000	0.0000	8.8900	0.0000	0.000000	62.5000	0.000000
207 15-74	12.2100	0.0000	19.7400	0.0000	0.0000	0.0000	9.2600	0.0000	0.000000	37.6400	0.000000
208 16-58	1.0100	15.1500	21.2100	0.0000	0.0000	0.0000	18.1800	0.0000	0.000000	37.2700	0.000000
209 17-21	0.0100	0.2200	20.5000	0.0000	0.0000	0.0000	29.7900	0.0000	0.000000	37.4200	0.000000
210 18-89	12.0300	0.3000	0.0000	0.0000	0.0000	0.0000	29.2100	0.0000	0.737450	36.5800	1.559180
211 19-73	12.4400	9.4300	0.0000	0.0000	0.0000	0.0000	7.5200	0.0000	0.725550	35.3300	1.534020
212 20-22	1.0400	0.3900	20.8500	0.0000	0.0000	0.0000	29.5600	0.0000	0.378250	37.4000	0.795500
213 21-38	2.9200	4.2300	5.2400	0.0000	0.0000	0.0000	16.3300	0.0000	0.207200	60.2000	0.438080
214 22-27	8.2700	7.4800	0.0000	0.0000	0.0000	0.0000	28.9100	0.0000	0.000000	35.5500	0.000000
215 23-61	0.0100	1.3100	13.4400	0.0000	0.0000	0.0000	13.4400	0.0000	0.384650	53.5500	0.613260
216 24-41	4.9800	0.6000	9.0500	0.0000	0.0000	0.0000	20.1000	0.0000	0.344050	46.2800	0.727420

0 Glass	12 B203	13 UO2	14 SrO	15 ZrO2	16 TiO2	17 K2O	18 CaO	19 Sb2O3	20 P2O5	21 Nd2O3
163 HWMAS2	10.4000	0.000000	0.000000	0.000000	0.0300	1.680000	0.160000	0.0000	0.200000	0.470000
164 HWMAS3	8.4000	0.000000	0.000000	0.000000	0.0300	23.300000	0.150000	0.0000	0.200000	0.400000
165 HWMAS4	9.0000	0.000000	0.000000	0.000000	0.0300	9.570000	0.160000	0.0000	0.200000	0.420000
166 HWMAS5	9.1000	0.000000	0.000000	0.000000	0.0300	13.200000	0.160000	0.0000	0.200000	0.410000
167 HWMAS6	9.4000	0.000000	0.000000	0.000000	0.0300	14.000000	0.160000	0.0000	0.200000	0.440000
168 HWYS1	9.7000	0.000000	0.310000	2.000000	0.0100	0.000000	0.670000	0.0000	0.060000	1.150000
169 HWYS2	9.8000	0.000000	0.110000	0.760000	0.0000	0.000000	0.250000	0.0000	0.020000	0.650000
170 HWYS3	9.7000	0.000000	0.280000	1.900000	0.0100	0.000000	0.570000	0.0000	0.050000	1.600000
171 HWYS4	9.7000	0.000000	0.000000	0.300000	0.0000	0.000000	0.050000	0.0000	0.010000	0.760000
172 HWYS5	9.7000	0.000000	0.120000	0.760000	0.0000	0.000000	0.200000	0.0000	0.020000	0.570000
173 HWYS6	9.8000	0.000000	0.040000	0.210000	0.0000	0.000000	0.060000	0.0000	0.010000	0.100000
174 HWYS7	9.4000	0.000000	0.120000	0.720000	0.0000	0.000000	0.230000	0.0000	0.020000	0.300000
175 hwys8	9.4000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.650000
176 HWYS10	9.5000	0.000000	0.120000	0.730000	0.0000	0.000000	0.230000	0.0000	0.020000	0.630000
177 HWYS11	9.5000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
178 HWYS12	9.8000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.750000
179 HWYS13	9.5000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
180 HWYS14	9.7000	0.000000	0.190000	1.230000	0.0000	0.000000	0.370000	0.0000	0.030000	0.650000
181 HWYS15	9.8000	0.000000	0.180000	1.240000	0.0000	0.000000	0.390000	0.0000	0.030000	1.300000
182 HWCRO	9.7800	0.000000	0.080000	0.600000	0.0000	0.000000	0.170000	0.0000	0.020000	0.490000
183 HWCRI	9.7400	0.000000	0.080000	0.600000	0.0000	0.000000	0.110000	0.0000	0.020000	0.480000
184 HWCRI34	9.6900	0.000000	0.080000	0.590000	0.0000	0.000000	0.170000	0.0000	0.020000	0.490000
185 HWCRI2	9.5500	0.000000	0.080000	0.670000	0.0000	0.000000	0.170000	0.0000	0.020000	0.490000
186 HWCRI5	9.6300	0.000000	0.080000	0.570000	0.0000	0.000000	0.170000	0.0000	0.020000	0.480000
187 U308_1	9.6500	0.000000	0.080000	0.560000	0.0200	0.000000	0.170000	0.0000	0.020000	0.430000
188 U308_2	9.5400	0.190000	0.080000	0.810000	0.0200	0.000000	0.170000	0.0000	0.020000	0.440000
189 U308_3	9.5000	2.170000	0.070000	0.600000	0.0300	0.000000	0.150000	0.0000	0.010000	0.410000
190 U308_4	9.5000	4.640000	0.070000	0.490000	0.0300	0.000000	0.140000	0.0000	0.010000	0.380000
191 U308_5	9.3300	6.200000	0.060000	0.450000	0.0300	0.000000	0.130000	0.0000	0.010000	0.330000
192 U308_6	9.3000	8.290000	0.060000	0.420000	0.0300	0.000000	0.110000	0.0000	0.010000	0.310000
193 1-9	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
194 2-38	20.4400	0.713000	0.094000	0.124000	0.0000	0.024800	0.093000	0.0000	1.686400	0.111600
195 3-16	0.0000	2.428800	0.316800	0.422400	0.0000	0.084480	0.316800	0.0000	5.744800	0.380160
196 4-44	7.6300	0.852150	0.111150	0.148200	0.0000	0.029840	0.111150	0.0000	2.015520	0.133380
197 5-40	6.3100	0.921150	0.120150	0.160200	0.0000	0.032040	0.120150	0.0000	2.178720	0.144180
198 6-71	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
199 7-34	8.4100	0.946450	0.123450	0.164600	0.0000	0.032920	0.123450	0.0000	2.238560	0.148140
200 8-62	11.0100	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
201 9-3	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
202 10-30	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
203 11-57	9.1100	2.360950	0.307950	0.410600	0.0000	0.092120	0.307950	0.0000	5.584160	0.369540
204 12-65	11.8600	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
205 13-60	8.9800	1.227050	0.160050	0.213400	0.0000	0.042680	0.160050	0.0000	2.902240	0.192860
206 14-67	8.5900	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
207 15-74	20.9600	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
208 16-58	7.1700	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
209 17-21	11.2600	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
210 18-89	0.0000	2.423050	0.316050	0.421400	0.0000	0.084280	0.316050	0.0000	5.731040	0.379260
211 19-73	14.5500	2.383950	0.310950	0.414600	0.0000	0.082920	0.310950	0.0000	5.638560	0.373140
212 20-22	0.0000	1.236250	0.161250	0.215000	0.0000	0.043000	0.161250	0.0000	2.924000	0.193500
213 21-36	5.1400	0.690800	0.088800	0.118400	0.0000	0.023680	0.088800	0.0000	1.610240	0.106560
214 22-27	19.8200	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
215 23-81	6.3700	1.263850	0.164850	0.219800	0.0000	0.043960	0.164850	0.0000	2.989280	0.197820
216 24-41	9.1600	1.130450	0.147450	0.196600	0.0000	0.039320	0.147450	0.0000	2.873760	0.176940

0 Glass	22 BaO	23 PbO	24 ThO2	25 28-D NSi (g/m**2)	26 pH	27 St. Ghyl (KC/Mol)	28 Jantzen's St. Ghyl	29 Ghyl (KC/Mol)	30 Jantzen's Ghyl
163 HWMAS2	0.1100	0.0000	0.000000	11.470000	9.970000	-5.483376	-4.024002	-5.820851	-4.381477
164 HWMAS3	0.0900	0.0000	0.000000	25.180000	9.370000	-9.101855	-8.836822	-9.781090	-7.518056
165 HWMAS4	0.1000	0.0000	0.000000	11.980000	9.000000	-6.984122	-5.178487	-7.321157	-5.535522
166 HWMAS5	0.0900	0.0000	0.000000	11.970000	9.130000	-8.101822	-8.010036	-8.554438	-6.462652
167 HWMAS6	0.1100	0.0000	0.000000	12.050000	9.060000	-7.683156	-5.659721	-8.082069	-6.058635
168 HWVS1	0.3800	0.0000	0.000000	40.150000	9.860000	-4.282935	-3.163372	-5.648154	-4.628591
169 HWVS2	0.1300	0.0000	0.000000	13.900000	9.480000	-6.008364	-4.417950	-6.815201	-5.224789
170 HWVS3	0.3300	0.0000	0.000000	42.410000	10.150000	-4.474459	-3.305220	-6.305951	-5.216718
171 HWVS4	0.0500	0.0000	0.000000	33.880000	9.820000	-3.255279	-2.550575	-4.553102	-3.848398
172 HWVS5	0.1200	0.0000	0.000000	13.520000	9.590000	-5.758717	-4.255087	-6.708285	-5.205235
173 HWVS6	0.0400	0.0000	0.000000	10.040000	8.960000	-3.401884	-2.878864	-3.733038	-3.008019
174 HWVS7	0.1300	0.0000	0.000000	8.150000	8.990000	-3.557227	-2.778885	-3.907642	-3.129300
175 HWVS8	0.0800	0.0000	0.000000	11.970000	9.730000	-9.354244	-8.573151	-10.507774	-7.726680
176 HWVS10	0.1300	0.0000	0.000000	13.210000	9.530000	-6.144154	-4.497845	-7.013949	-5.387439
177 HWVS11	0.0000	0.0000	0.000000	14.580000	10.220000	-9.038155	-6.373010	-11.095806	-8.430681
178 HWVS12	0.0000	0.0000	0.000000	9.750000	9.530000	-3.347748	-2.643574	-4.217542	-3.513368
179 HWVS13	0.0000	0.0000	0.000000	82.550000	10.950000	-8.996662	-6.267489	-12.836038	-10.106884
180 HWVS14	0.2200	0.0000	0.000000	34.530000	10.130000	-3.785178	-2.845961	-5.635882	-4.718685
181 HWVS15	0.2200	0.0000	0.000000	33.880000	10.050000	-3.911160	-2.959317	-5.623180	-4.671337
182 HWCR0	0.0890	0.0000	0.000000	12.060000	9.680000	-4.157170	-3.646068	-5.234978	-4.733091
183 HWCR1	0.0850	0.0000	0.000000	12.180000	9.690000	-5.181205	-3.886585	-6.273900	-4.979261
184 HWCR134	0.0850	0.0000	0.000000	12.180000	9.650000	-5.284221	-3.935438	-6.298124	-4.989338
185 HWCR2	0.0840	0.0000	0.000000	11.440000	9.710000	-5.085397	-3.801191	-6.208255	-4.924048
186 HWCR5	0.0840	0.0000	0.000000	12.420000	9.730000	-5.802147	-4.179049	-6.756678	-5.332579
187 U308_1	0.0900	0.0000	0.000000	11.100000	9.800000	-5.462503	-4.072997	-6.425790	-5.036284
188 U308_2	0.1000	0.0000	0.000000	11.900000	9.800000	-5.454590	-4.068597	-6.417877	-5.029894
189 U308_3	0.0800	0.0000	0.000000	12.300000	9.400000	-5.372501	-4.020412	-6.086180	-4.733091
190 U308_4	0.0800	0.0000	0.000000	13.000000	9.400000	-5.638110	-4.215079	-6.350788	-4.927757
191 U308_5	0.0800	0.0000	0.000000	12.700000	9.500000	-5.501852	-4.142443	-6.333491	-4.974082
192 U308_6	0.0800	0.0000	0.000000	13.900000	9.400000	-5.798852	-4.349848	-6.509330	-5.062525
193 1-9	0.0000	0.0000	0.000000	14.800000	9.500000	-1.268791	-1.023135	-1.424015	-1.186359
194 2-38	0.0000	0.0000	2.201000	70.900000	9.500000	-9.530993	-7.126612	-10.362632	-7.958251
195 3-15	0.0000	0.0000	7.497800	12.800000	9.200000	-3.157821	-2.563270	-3.245100	-2.650549
196 4-44	0.0000	0.0000	2.830550	9.500000	9.400000	-9.369928	-6.643797	-10.082605	-7.358478
197 5-40	0.0000	0.0000	2.843550	237.400000	12.300000	-16.898495	-10.282772	-24.945807	-18.532184
198 6-71	0.0000	0.0000	0.000000	24.500000	12.200000	-24.051295	-12.035658	-27.621130	-15.605491
199 7-34	0.0000	0.0000	2.921650	13.200000	9.800000	-9.934825	-6.967558	-11.199700	-8.232433
200 8-62	0.0000	0.0000	0.000000	13.900000	9.200000	-4.057084	-3.268345	-4.568058	-3.780120
201 9-3	0.0000	0.0000	0.000000	5.000000	8.800000	0.878028	0.758855	0.841759	0.722388
202 10-30	0.0000	0.0000	0.000000	345.700000	13.000000	-23.958678	-11.754794	-29.476635	-17.274752
203 11-57	0.0000	0.0000	7.288150	518.500000	12.300000	-19.278333	-12.171187	-27.527725	-20.420579
204 12-85	0.0000	0.0000	0.000000	28.200000	9.300000	-2.872645	-2.393700	-3.478825	-2.999880
205 13-80	0.0000	0.0000	3.787850	32.700000	9.500000	-6.097325	-4.718018	-6.928964	-5.549657
206 14-87	0.0000	0.0000	0.000000	18.800000	8.800000	2.028284	1.859389	1.868013	1.697918
207 15-74	0.0000	0.0000	0.000000	8.700000	8.400000	-1.983757	-1.759835	-2.089416	-1.865495
208 16-58	0.0000	0.0000	0.000000	11.400000	10.800000	-13.189632	-7.990489	-16.122990	-10.923846
209 17-21	0.0000	0.0000	0.000000	159.200000	11.700000	-13.827128	-9.059677	-19.891673	-15.124222
210 18-89	0.0000	0.0000	7.479850	29.400000	11.300000	-17.901858	-11.181999	-19.808189	-13.088530
211 19-73	0.0000	0.0000	7.359150	8.900000	8.400000	-8.351599	-6.397141	-8.457258	-6.528801
212 20-22	0.0000	0.0000	3.818250	161.700000	12.300000	-15.022959	-9.331222	-18.818462	-13.124725
213 21-36	0.0000	0.0000	2.101800	10.900000	9.500000	-5.039872	-3.888520	-5.871311	-4.720160
214 22-27	0.0000	0.0000	0.000000	58.000000	11.800000	-11.895142	-11.895142	-25.416739	-18.093315
215 23-81	0.0000	0.0000	3.901450	19.300000	9.400000	-3.388162	-2.704280	-4.018841	-3.418958
216 24-41	0.0000	0.0000	3.489850	17.700000	9.600000	-7.998099	-6.024773	-8.961386	-6.988060

0 Glass	31 NBO	32 Val. Par.	33
163 HWMAS2	0.423652	-0.489578	2.439735
164 HWMAS3	0.389368	-0.538077	3.226050
165 HWMAS4	0.411082	-0.513343	2.481568
166 HWMAS5	0.408456	-0.518868	2.482484
167 HWMAS6	0.424913	-0.497589	2.489065
168 HWVS1	0.652738	-0.575013	3.692822
169 HWVS2	0.478348	-0.494335	2.631889
170 HWVS3	0.643423	-0.589383	3.747384
171 HWVS4	0.339231	-0.803797	3.522825
172 HWVS5	0.470954	-0.584197	2.804170
173 HWVS6	0.284853	-0.619125	2.306577
174 HWVS7	0.347863	-0.623826	2.098018
175 HWVS8	0.454339	-0.370378	2.482484
176 HWVS10	0.483509	-0.488838	2.580974
177 HWVS11	0.485431	-0.363228	2.678278
178 HWVS12	0.187581	-0.638787	2.277267
179 HWVS13	0.483370	-0.340318	4.413404
180 HWVS14	0.475003	-0.584938	3.541829
181 HWVS15	0.501650	-0.583838	3.522825
182 HWCRC	0.367307	-0.523754	2.489894
183 HWCRC1	0.384829	-0.534238	2.499795
184 HWCRC134	0.400024	-0.527786	2.499795
185 HWCRC2	0.419974	-0.530042	2.437116
186 HWCRC5	0.368005	-0.521503	2.519308
187 U308_1	0.405191	-0.518482	2.408945
188 U308_2	0.409128	-0.520418	2.476538
189 U308_3	0.431379	-0.529750	2.509599
190 U308_4	0.464194	-0.525898	2.564949
191 U308_5	0.480025	-0.528802	2.541802
192 U308_6	0.515480	-0.521746	2.631889
193 1-9	0.185046	-0.614865	2.694827
194 2-38	0.454374	-0.457892	4.261270
195 3-15	0.323875	-0.668141	2.549445
196 4-44	0.451234	-0.493547	2.251292
197 5-40	0.727044	-0.193719	5.409746
198 6-71	0.781667	-0.282986	3.198673
199 7-34	0.525965	-0.470843	2.580217
200 8-62	0.214838	-0.572026	2.631889
201 9-3	0.008615	-0.727506	1.609438
202 10-30	0.886182	-0.187588	5.845571
203 11-57	0.834498	-0.096458	6.247075
204 12-85	0.232825	-0.597777	3.339322
205 13-60	0.398922	-0.551939	3.487375
206 14-67	-0.028857	-0.829961	2.809403
207 15-74	-0.141976	-0.720614	2.183323
208 16-58	0.588882	-0.474382	2.433613
209 17-21	0.495591	-0.101213	5.070161
210 18-69	0.730033	-0.212531	3.380995
211 19-73	0.450341	-0.771489	1.931521
212 20-22	0.829427	-0.178171	5.085743
213 21-38	0.417095	-0.598958	2.388763
214 22-27	0.665877	-0.079136	4.025352
215 23-61	0.313705	-0.847888	2.980105
216 24-41	0.416987	-0.445760	2.873585

0 Glass	1 Al2O3	2 CaO	3 Fe2O3	4 FeO	5 MgO	6 MnO	7 Na2O	8 Li2O	9 NiO	10 SiO2	11 Cr2O3
217 25-64	12.4900	0.4200	0.0000	0.0000	0.0000	0.0000	15.6300	0.0000	0.000000	59.8800	0.000000
218 26-10	0.8400	0.2000	0.8000	0.0000	0.0000	0.0000	11.8800	0.0000	0.000000	61.2000	0.000000
219 27-2	8.3800	0.2100	0.0000	0.0000	0.0000	0.0000	29.9800	0.0000	0.000000	61.4500	0.000000
220 28-45	5.0400	7.9300	0.0000	0.0000	0.0000	0.0000	20.8200	0.0000	0.323050	47.2100	0.683020
221 29-37	5.2400	7.6800	0.5600	0.0000	0.0000	0.0000	20.9500	0.0000	0.322700	47.3500	0.682260
222 30-14	8.8000	15.4800	0.0000	0.0000	0.0000	0.0000	12.7200	0.0000	0.746200	41.6700	1.577680
223 31-1	8.1500	14.9600	0.0000	0.0000	0.0000	0.0000	16.6500	0.0000	0.000000	60.2500	0.000000
224 32-70	12.5500	0.2100	0.0000	0.0000	0.0000	0.0000	11.2300	0.0000	0.714000	35.7700	1.509600
225 33-6	8.3200	0.1400	0.0000	0.0000	0.0000	0.0000	11.8900	0.0000	0.000000	60.4300	0.000000
226 34-18	8.4700	0.2000	0.0000	0.0000	0.0000	0.0000	12.1500	0.0000	0.711900	38.9200	1.505160
227 35-35	5.5100	0.0500	5.8000	0.0000	0.0000	0.0000	21.9300	0.0000	0.326550	38.9400	0.690420
228 36-19	6.9800	0.2600	20.3100	0.0000	0.0000	0.0000	29.8400	0.0000	0.000000	40.6200	0.000000
229 37-31	0.4000	15.3100	0.0000	0.0000	0.0000	0.0000	28.1300	0.0000	0.748650	34.7800	1.582860
230 38-53	0.6400	0.1700	4.2700	0.0000	0.0000	0.0000	29.4400	0.0000	0.178500	60.3800	0.377400
231 39-59	12.4000	13.7000	4.3000	0.0000	0.0000	0.0000	7.0000	0.0000	0.198350	50.9900	0.415140
232 40-47	5.0700	7.7500	9.7400	0.0000	0.0000	0.0000	20.7800	0.0000	0.000000	47.1200	0.000000
233 41-63	12.5400	1.2000	6.0200	0.0000	0.0000	0.0000	16.2500	0.0000	0.000000	54.2600	0.000000
234 42-34	4.4600	8.3300	0.0000	0.0000	0.0000	0.0000	19.7300	0.0000	0.269150	45.6900	0.569060
235 43-11	6.4200	0.3100	0.0000	0.0000	0.0000	0.0000	12.0400	0.0000	0.735000	60.2200	1.554000
236 44-23	0.9000	0.1600	11.5100	0.0000	0.0000	0.0000	30.1300	0.0000	0.733600	30.3400	1.551040
237 45-17	8.2500	0.0700	0.0000	0.0000	0.0000	0.0000	29.8400	0.0000	0.742000	40.6300	1.568800
238 46-58	9.1300	0.1000	20.2000	0.0000	0.0000	0.0000	12.3100	0.0000	0.466550	36.9200	0.986420
239 47-4	0.4100	0.1500	0.0000	0.0000	0.0000	0.0000	13.2800	0.0000	0.686000	60.5500	1.450400
240 48-32	6.1800	0.4000	17.4900	0.0000	0.0000	0.0000	10.9700	0.0000	0.685050	43.3600	1.449660
241 49-13	0.2900	15.1100	0.0000	0.0000	0.0000	0.0000	12.6000	0.0000	0.000000	51.7400	0.000000
242 50-5	1.0400	0.1300	0.0000	0.0000	0.0000	0.0000	18.1600	0.0000	0.704900	60.5300	1.490360
243 51-66	5.6300	0.5300	4.7300	0.0000	0.0000	0.0000	14.5400	0.0000	0.128800	60.5700	0.272320
244 52-42	3.6500	15.1100	0.4600	0.0000	0.0000	0.0000	18.1400	0.0000	0.213150	43.9900	0.450860
245 53-52	0.6400	14.8900	5.5700	0.0000	0.0000	0.0000	12.0500	0.0000	0.227150	60.3600	0.480260
246 54-72	12.0800	15.1100	0.0000	0.0000	0.0000	0.0000	18.3300	0.0000	0.000000	34.7400	0.000000
247 55-27	8.1700	7.0700	0.0000	0.0000	0.0000	0.0000	30.3800	0.0000	0.000000	34.7600	0.000000
248 56-88	0.8300	10.9400	0.0000	0.0000	0.0000	0.0000	7.3300	0.0000	0.768800	59.9400	1.625040
249 57-7	1.1100	4.2300	20.0200	0.0000	0.0000	0.0000	12.2700	0.0000	0.000000	62.3700	0.000000
250 58-39	5.2400	7.0900	9.1900	0.0000	0.0000	0.0000	12.3700	0.0000	0.313950	47.8500	0.663780
251 59-6	8.3200	0.1600	0.0000	0.0000	0.0000	0.0000	11.9300	0.0000	0.000000	60.1400	0.000000
252 60-20	8.4800	0.2400	19.4300	0.0000	0.0000	0.0000	11.7200	0.0000	0.000000	36.5700	0.000000
253 61-60	1.0100	2.4800	12.8100	0.0000	0.0000	0.0000	16.2900	0.0000	0.397950	47.1400	0.841380
254 62-54	4.3800	15.4500	0.0000	0.0000	0.0000	0.0000	12.3200	0.0000	0.431200	35.4900	0.911680
255 63-34	4.4200	6.2700	7.9200	0.0000	0.0000	0.0000	19.8400	0.0000	0.290150	45.2400	0.613480
256 64-29	0.8500	9.1800	20.1700	0.0000	0.0000	0.0000	12.5100	0.0000	0.000000	37.3200	0.000000
257 65-49	0.9500	15.4500	17.1300	0.0000	0.0000	0.0000	12.5100	0.0000	0.564200	37.8400	1.192880
258 67-75	12.8200	0.1900	19.6800	0.0000	0.0000	0.0000	30.4800	0.0000	0.000000	38.8400	0.000000
259 68-50	0.9800	0.4000	20.6300	0.0000	0.0000	0.0000	6.8900	0.0000	0.000000	62.5000	0.000000
260 69-16	9.9600	15.6800	20.3700	0.0000	0.0000	0.0000	12.7300	0.0000	0.000000	42.2600	0.000000
261 70-55	4.5200	0.2500	9.3300	0.0000	0.0000	0.0000	31.0100	0.0000	0.000000	35.1200	0.000000
262 72-2	8.3600	0.3300	0.0000	0.0000	0.0000	0.0000	30.8400	0.0000	0.000000	60.4700	0.000000
263 73-1	6.3000	15.3000	0.0000	0.0000	0.0000	0.0000	17.4000	0.0000	0.000000	59.0000	0.000000
264 74-12	0.3800	14.9200	0.0000	0.0000	0.0000	0.0000	30.3400	0.0000	0.000000	54.3600	0.000000
265 75-26	8.5400	15.0200	0.0000	0.0000	0.0000	0.0000	12.2900	0.0000	0.718200	35.3300	1.519480
266 76-29	0.4600	11.1200	0.0000	0.0000	0.0000	0.0000	12.2100	0.0000	0.747800	35.5900	1.580640
267 77-25	9.4500	15.4800	8.4500	0.0000	0.0000	0.0000	12.5300	0.0000	0.000000	35.3400	0.000000
268 78-48	3.5000	4.3300	5.6600	0.0000	0.0000	0.0000	17.9200	0.0000	0.717150	42.3300	1.516260
269 79-43	0.7700	0.8600	9.4900	0.0000	0.0000	0.0000	20.7700	0.0000	0.314300	45.4400	0.864520
270 80-46	3.5900	4.3000	19.9800	0.0000	0.0000	0.0000	17.4200	0.0000	0.214900	43.0300	0.454360

0 Glass	12 B203	13 UO2	14 SrO	15 ZrO2	16 TiO2	17 K2O	18 Cs2O	19 Sb2O3	20 P2O5	21 Nd2O3
217 25-84	11.5900	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
218 26-10	19.3100	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
219 27-2	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
220 28-46	9.7700	1.061450	0.138450	0.184600	0.0000	0.036920	0.138450	0.0000	2.510560	0.166140
221 29-37	0.0000	1.060300	0.138300	0.184400	0.0000	0.036880	0.138300	0.0000	2.507840	0.165980
222 30-14	0.0000	2.451800	0.319800	0.426400	0.0000	0.085280	0.319800	0.0000	5.799040	0.383760
223 31-1	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
224 32-70	19.8300	2.346000	0.306000	0.408000	0.0000	0.081600	0.306000	0.0000	5.548800	0.367200
225 33-8	19.2200	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
226 34-18	19.9200	2.339100	0.305100	0.406800	0.0000	0.081360	0.305100	0.0000	5.532480	0.366120
227 35-35	10.4400	1.072950	0.139950	0.186800	0.0000	0.037320	0.139950	0.0000	2.537760	0.167940
228 36-19	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
229 37-31	0.0000	2.459850	0.320850	0.427800	0.0000	0.085560	0.320850	0.0000	5.818080	0.386020
230 38-53	0.0000	0.586500	0.076500	0.102000	0.0000	0.020400	0.076500	0.0000	1.387200	0.091800
231 39-59	0.0000	0.645150	0.084150	0.112200	0.0000	0.022440	0.084150	0.0000	1.525920	0.100980
232 40-47	9.5400	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
233 41-63	9.7300	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
234 42-34	0.1000	0.884350	0.115350	0.159000	0.0000	0.030760	0.115350	0.0000	2.091600	0.138420
235 43-11	0.0000	2.415000	0.315000	0.420000	0.0000	0.084000	0.315000	0.0000	5.712000	0.378000
236 44-23	0.0000	2.410400	0.314400	0.419200	0.0000	0.083840	0.314400	0.0000	5.701120	0.377260
237 45-17	0.0000	2.438000	0.318000	0.424000	0.0000	0.084800	0.318000	0.0000	5.768400	0.381600
238 46-56	0.0000	1.532950	0.199950	0.268800	0.0000	0.053320	0.199950	0.0000	3.625760	0.239940
239 47-4	0.0100	2.254000	0.294000	0.392000	0.0000	0.078400	0.294000	0.0000	5.331200	0.352800
240 48-32	0.0000	2.252850	0.293850	0.391800	0.0000	0.078360	0.293850	0.0000	5.328480	0.352620
241 49-13	20.0500	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
242 50-5	0.0000	2.316100	0.302100	0.402800	0.0000	0.080560	0.302100	0.0000	5.478080	0.362520
243 51-66	10.3100	0.423200	0.055200	0.073600	0.0000	0.014720	0.055200	0.0000	1.000960	0.066240
244 52-42	6.5700	0.700350	0.091350	0.121800	0.0000	0.024360	0.091350	0.0000	1.656480	0.109620
245 53-52	0.0000	0.746350	0.097350	0.129800	0.0000	0.025960	0.097350	0.0000	1.765280	0.116820
246 54-72	19.7400	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
247 55-27	19.6200	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
248 56-68	0.0000	2.525400	0.329400	0.439200	0.0000	0.087840	0.329400	0.0000	5.973120	0.395280
249 57-7	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
250 58-39	9.2900	1.031550	0.134550	0.179400	0.0000	0.035880	0.134550	0.0000	2.439840	0.161460
251 59-6	19.4500	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
252 60-20	23.5800	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
253 61-80	8.9100	1.307550	0.170550	0.227400	0.0000	0.045480	0.170550	0.0000	3.092640	0.204680
254 62-54	20.0400	1.416800	0.184800	0.246400	0.0000	0.049280	0.184800	0.0000	3.351040	0.221760
255 63-34	8.0200	0.953350	0.124350	0.165800	0.0000	0.033160	0.124350	0.0000	2.254880	0.149220
256 64-28	19.9700	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
257 65-49	0.0000	1.053800	0.241800	0.322400	0.0000	0.084480	0.241800	0.0000	4.384640	0.290160
258 67-75	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
259 68-50	8.5900	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
260 69-16	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
261 70-55	19.7700	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
262 72-2	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
263 73-1	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
264 74-12	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
265 75-26	8.3000	2.359800	0.307800	0.410400	0.0000	0.082080	0.307800	0.0000	5.561440	0.369360
266 76-29	19.2500	2.456400	0.320400	0.427200	0.0000	0.085440	0.320400	0.0000	5.809920	0.384480
267 77-25	19.7600	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
268 78-48	5.7700	2.356350	0.307350	0.409800	0.0000	0.081960	0.307350	0.0000	5.573280	0.368820
269 79-43	8.7000	1.032700	0.134700	0.179600	0.0000	0.035920	0.134700	0.0000	2.442560	0.161640
270 80-46	5.5300	0.706100	0.092100	0.122800	0.0000	0.024560	0.092100	0.0000	1.670000	0.110520

0 Glass	22 BaO	23 PbO	24 ThO2	25 28-D NSi (g/m**2)	26 pH	27 St. Ghyl (KC/Mol)	28 Jantzen's St. Ghyl	29 Ghyl (KC/Mol)	30 Jantzen's Ghyl
217 25-64	0.0000	0.0000	0.000000	4.000000	8.500000	-3.538241	-2.943852	-3.669091	-3.074502
218 26-10	0.0000	0.0000	0.000000	25.300000	9.000000	-2.262323	-1.975920	-2.019350	-2.332955
219 27-2	0.0000	0.0000	0.000000	704.100000	12.700000	-9.725163	-6.749455	-14.477557	-11.501849
220 28-45	0.0000	0.0000	3.276650	22.600000	10.200000	-12.263918	-8.295234	-14.279278	-10.310594
221 29-37	0.0000	0.0000	3.273100	10.600000	10.300000	-10.738462	-7.089181	-11.396249	-7.746968
222 30-14	0.0000	0.0000	7.568600	7.500000	10.000000	-12.805614	-8.132805	-13.219215	-8.546405
223 31-1	0.0000	0.0000	0.000000	8.700000	10.300000	-8.483154	-6.676188	-9.140940	-6.333974
224 32-70	0.0000	0.0000	7.242000	10.300000	8.600000	-6.950204	-5.859960	-7.111735	-6.021431
225 33-6	0.0000	0.0000	0.000000	4.400000	8.800000	-2.585856	-2.263260	-2.885559	-2.505983
226 34-18	0.0000	0.0000	7.220700	12.800000		-7.175581	-5.994434	-7.175581	-5.994434
227 35-35	0.0000	0.0000	3.312150	19.700000	10.400000	-14.445197	-9.350742	-16.901479	-11.807025
228 36-19	0.0000	0.0000	0.000000	76.300000	12.000000	-11.945335	-7.729751	-15.090980	-10.875396
229 37-31	0.0000	0.0000	7.593450	1213.000000	13.000000	-30.492708	-14.469231	-36.012665	-19.989188
230 38-53	0.0000	0.0000	1.810500	678.600000	12.200000	-10.278400	-7.082326	-13.840235	-10.632161
231 39-59	0.0000	0.0000	1.991550	5.600000	9.300000	-3.298193	-2.485200	-3.396161	-2.593169
232 40-47	0.0000	0.0000	0.000000	11.600000	10.000000	-10.092494	-6.918338	-11.709067	-8.534911
233 41-63	0.0000	0.0000	0.000000	9.000000	9.000000	-4.043594	-3.272490	-4.400629	-3.629525
234 42-34	0.0000	0.0000	2.729950	13.400000	9.900000	-10.168907	-7.078708	-11.603606	-8.513307
235 43-11	0.0000	0.0000	7.455000	3.600000	8.800000	-2.775480	-2.334333	-2.811748	-2.370600
236 44-23	0.0000	0.0000	7.440800	521.400000	12.600000	-18.683658	-11.276533	-23.168051	-15.780927
237 45-17	0.0000	0.0000	7.526800	24.900000	11.000000	-17.454859	-10.964918	-18.927548	-12.437608
238 46-56	0.0000	0.0000	4.732150	8.300000	9.600000	-6.419445	-4.585589	-6.018842	-4.784787
239 47-4	0.0000	0.0000	8.958000	10.000000	9.900000	-3.970344	-3.313897	-5.404943	-4.748296
240 48-32	0.0000	0.0000	8.954450	9.700000	9.100000	-2.328443	-1.936549	-2.398770	-2.006875
241 49-13	0.0000	0.0000	0.000000	31.700000	9.900000	-9.541452	-6.751768	-10.978050	-8.186387
242 50-5	0.0000	0.0000	7.149700	15.300000	10.300000	-5.959848	-4.642651	-6.617635	-5.300438
243 51-66	0.0000	0.0000	1.306400	6.700000	9.400000	-3.079194	-2.572920	-3.791872	-3.285599
244 52-42	0.0000	0.0000	2.161950	14.500000	10.500000	-13.637972	-8.464886	-16.328649	-11.155564
245 53-52	0.0000	0.0000	2.303950	21.700000	10.200000	-6.480682	-4.519789	-7.049062	-5.089169
246 54-72	0.0000	0.0000	0.000000	10.000000	9.800000	-15.554898	-9.866087	-16.818772	-11.130962
247 55-27	0.0000	0.0000	0.000000	97.300000	12.200000	-20.119515	-12.154959	-27.972080	-20.007525
248 56-68	0.0000	0.0000	7.795800	9.400000	9.000000	-4.703472	-3.597838	-4.759986	-3.854352
249 57-7	0.0000	0.0000	0.000000	16.000000	9.500000	-0.570176	-0.462497	-0.733400	-0.625720
250 58-39	0.0000	0.0000	3.184350	8.800000	9.100000	-5.910061	-4.518180	-6.348007	-4.947126
251 59-6	0.0000	0.0000	0.000000	4.300000	8.800000	-2.654635	-2.321639	-2.897337	-2.564342
252 60-20	0.0000	0.0000	0.000000	20.900000	8.900000	-3.835519	-3.284179	-4.130770	-3.579430
253 61-60	0.0000	0.0000	4.036350	33.300000	9.700000	-6.466122	-4.968098	-7.573835	-6.078611
254 62-54	0.0000	0.0000	4.373800	24.900000	9.700000	-13.899309	-9.277399	-15.007022	-10.385112
255 63-34	0.0000	0.0000	2.942950	13.400000	9.800000	-10.380764	-7.204642	-11.045859	-8.469517
256 64-28	0.0000	0.0000	0.000000	23.700000	9.500000	-7.568320	-5.603666	-8.399959	-6.435305
257 65-49	0.0000	0.0000	5.722600	9.200000	10.200000	-11.536668	-7.195589	-12.105047	-7.763969
258 67-75	0.0000	0.0000	0.000000	61.000000	11.900000	-13.076566	-8.305906	-16.022241	-11.251581
259 68-50	0.0000	0.0000	0.000000	88.500000	13.200000	2.028284	1.859389	-10.437945	-10.606839
260 69-16	0.0000	0.0000	0.000000	7.200000	10.100000	-7.574903	-4.957812	-8.061825	-5.444733
261 70-55	0.0000	0.0000	0.000000	122.600000	11.800000	-16.291378	-10.719840	-22.689551	-17.118013
262 72-2	0.0000	0.0000	0.000000	812.800000	12.700000	-10.449461	-7.143862	-15.200855	-11.896256
263 73-1	0.0000	0.0000	0.000000	7.900000	10.200000	-9.257832	-6.088322	-9.826212	-6.656702
264 74-12	0.0000	0.0000	0.000000	99.700000	12.500000	-19.316616	-10.545632	-23.607056	-14.807073
265 75-26	0.0000	0.0000	7.284600	8.400000	9.400000	-14.151880	-9.121807	-14.864559	-9.834486
266 76-29	0.0000	0.0000	7.582800	57.800000	9.700000	-13.214282	-9.243846	-14.321995	-10.351559
267 77-25	0.0000	0.0000	0.000000	9.200000	9.700000	-11.317473	-7.675418	-12.425186	-8.783131
268 78-48	0.0000	0.0000	7.273950	12.200000	9.700000	-10.590176	-7.526324	-11.634037	-8.634037
269 79-43	0.0000	0.0000	3.187900	90.300000	10.700000	-11.520592	-7.811604	-14.704242	-10.995254
270 80-46	0.0000	0.0000	2.179700	17.000000	10.000000	-6.838751	-4.992535	-8.455324	-6.609108

Ø Glass	31 NBO	32 Val. Par.	33
217 25-84	0.177542	-0.615041	1.386294
218 26-10	0.189728	-0.678208	3.230804
219 27-2	0.508711	-0.304261	6.558920
220 28-45	0.646831	-0.424929	3.117950
221 29-37	0.592187	-0.464256	2.380854
222 30-14	0.769534	-0.663468	2.014903
223 31-1	0.562974	-0.613586	2.163323
224 32-70	0.291351	-0.645538	2.332144
225 33-6	0.144741	-0.680873	1.481606
226 34-18	0.367430	-0.616546	2.549445
227 35-35	0.648582	-0.358500	2.980619
228 36-19	0.393256	-0.224696	4.334673
229 37-31	1.205997	-0.183820	7.100852
230 38-53	0.618191	-0.288957	6.520032
231 39-59	0.328352	-0.837212	1.722767
232 40-47	0.481923	-0.435107	2.451006
233 41-63	0.165286	-0.592208	2.197225
234 42-34	0.534383	-0.458034	2.595255
235 43-11	0.389093	-0.711847	1.280934
236 44-23	0.839512	-0.140607	6.256516
237 45-17	0.791054	-0.198321	3.214868
238 46-58	0.337658	-0.671017	2.116256
239 47-4	0.472801	-0.661449	2.302586
240 48-32	0.193661	-0.714465	2.272126
241 49-13	0.581256	-0.625851	3.456317
242 50-5	0.579116	-0.558246	2.727853
243 51-68	0.242084	-0.634718	1.902108
244 52-42	0.700037	-0.501089	2.674149
245 53-52	0.596571	-0.710509	3.077312
246 54-72	0.578118	-0.430433	2.302586
247 55-27	0.688776	-0.026317	4.577799
248 56-88	0.623961	-0.818048	2.240710
249 57-7	0.189470	-0.712902	2.772589
250 58-39	0.386590	-0.664126	2.174752
251 59-8	0.146076	-0.684707	1.458615
252 60-20	-0.017046	-0.626510	3.039749
253 61-60	0.419826	-0.548057	3.505557
254 62-54	0.696100	-0.595816	3.214868
255 63-34	0.543917	-0.453184	2.595255
256 64-28	0.327945	-0.598865	3.165476
257 65-49	0.705488	-0.852480	2.219203
258 67-75	0.382779	-0.203084	4.110874
259 68-50	-0.028857	-0.829961	4.483003
260 69-16	0.384052	-0.676290	1.974081
261 70-55	0.544752	0.009713	4.808927
262 72-2	0.529538	-0.279452	6.700465
263 73-1	0.584029	-0.593376	2.068863
264 74-12	0.903649	-0.239932	4.602166
265 75-28	0.748322	-0.638715	2.128232
266 76-29	0.759503	-0.587574	4.058989
267 77-25	0.460856	-0.607810	2.219203
268 78-48	0.637852	-0.495497	2.501436
269 79-43	0.626032	-0.414120	4.503137
270 80-46	0.350132	-0.524219	2.833213

0 Glass	1 Al2O3	2 CaO	3 Fe2O3	4 FeO	5 MgO	6 MnO	7 Na2O	8 Li2O	9 NiO	10 SiO2	11 Cr2O3
271 81-34	4.4200	0.3700	7.9100	0.0000	0.0000	0.0000	19.6300	0.0000	0.294700	45.2300	0.623080
272 82-24	0.3400	0.0000	0.0000	0.0000	0.0000	0.0000	29.3300	0.0000	0.610400	33.8100	1.290580
273 83-8	0.4400	0.2500	0.0000	0.0000	0.0000	0.0000	21.0300	0.0000	0.000000	58.8100	0.000000
274 84-51	0.9300	0.2000	14.9000	0.0000	0.0000	0.0000	12.3400	0.0000	0.535850	36.5900	1.132940
275 85-16	8.8300	15.8400	20.0000	0.0000	0.0000	0.0000	12.5900	0.0000	0.000000	42.7400	0.000000
276 86-88	12.2200	0.1000	0.0000	0.0000	0.0000	0.0000	26.6800	0.0000	0.000000	81.0000	0.000000
277 87-88	7.9100	13.8400	4.6200	0.0000	0.0000	0.0000	28.1100	0.0000	0.207550	39.5900	0.438820
278 88-91	0.5000	15.1700	2.5800	0.0000	0.0000	0.0000	18.1900	0.0000	0.214200	51.5400	0.452880
279 89-77	0.0000	0.1600	17.9800	0.0000	0.0000	0.0000	12.1900	0.0000	0.000000	45.0100	0.000000
280 90-85	0.7000	12.2800	12.6400	0.0000	0.0000	0.0000	12.1800	0.0000	0.603050	44.9700	1.275020
281 91-89	12.4800	0.1900	10.1400	0.0000	0.0000	0.0000	15.1300	0.0000	0.377300	41.7000	0.797720
282 92-84	3.8400	5.1200	8.6400	0.0000	0.0000	0.0000	18.7100	0.0000	0.524850	44.1700	1.109280
283 93-81	0.3100	0.3800	0.0000	0.0000	0.0000	0.0000	12.8800	0.0000	0.469350	47.5400	0.992340
284 94-92	3.4400	0.2500	0.0000	0.0000	0.0000	0.0000	18.7500	0.0000	0.717850	51.1700	1.517740
285 95-90	12.8100	0.9700	10.2700	0.0000	0.0000	0.0000	15.2500	0.0000	0.382550	40.7700	0.808820
286 96-76	0.3200	12.9700	0.0000	0.0000	0.0000	0.0000	28.5400	0.0000	0.000000	60.1700	0.000000
287 97-82	0.2700	11.7800	0.0000	0.0000	0.0000	0.0000	22.7000	0.0000	0.641803	48.3400	1.358533
288 98-79	0.6100	0.4400	9.6400	0.0000	0.0000	0.0000	28.5800	0.0000	0.647150	44.2400	1.368280
289 99-78	0.9200	12.1700	14.5400	0.0000	0.0000	0.0000	12.7900	0.0000	0.374150	48.8900	0.791080
290 100-93	4.6100	7.8100	10.8600	0.0000	0.0000	0.0000	10.2800	0.0000	0.387100	55.4100	0.818440
291 101-80	7.2700	13.0900	7.4700	0.0000	0.0000	0.0000	11.9800	0.0000	0.000000	43.1400	0.000000
292 102-87	11.6500	0.1900	0.0000	0.0000	0.0000	0.0000	9.9700	0.0000	0.648550	42.7800	1.371220
293 103-83	0.3300	10.6400	0.0000	0.0000	0.0000	0.0000	22.1000	0.0000	0.000000	52.1800	0.000000
294 SRL-165NR	4.8800	0.9700	10.8000	0.0000	0.7500	0.0000	10.9000	5.0500	0.850000	51.3800	0.140000
295 WY205NR	3.3100	0.6100	11.8400	0.0000	1.3100	0.0000	11.0300	3.0500	0.700000	45.2000	0.220000
296 UK209	5.2200	0.0000	11.7100	0.0000	5.6900	0.0000	8.2500	4.0900	0.330000	53.0200	0.360000
297 SRL-131	3.0500	1.0400	14.2800	0.0000	1.2400	0.0000	14.7700	3.8900	1.540000	38.8000	0.180000

0 Glass	12 B203	13 U02	14 Sr0	15 Zr02	16 Ti02	17 K20	18 Ca20	19 Sb203	20 P205	21 Nd203
271 81-34	0.0200	0.988300	0.128300	0.168400	0.0000	0.033680	0.126300	0.0000	2.290240	0.151500
272 82-24	19.0900	2.005600	0.261800	0.348800	0.0000	0.069760	0.261600	0.0000	4.743880	0.313920
273 83-8	19.4700	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
274 84-51	19.7400	1.760850	0.229650	0.306200	0.0000	0.061240	0.229650	0.0000	4.164320	0.275580
275 85-18	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
276 86-88	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
277 87-88	0.0000	0.681950	0.088950	0.118600	0.0000	0.023720	0.088950	0.0000	1.612960	0.106740
278 88-91	5.9200	0.703800	0.091800	0.122400	0.0000	0.024480	0.091800	0.0000	1.664640	0.110180
279 89-77	16.6800	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
280 90-85	0.0000	1.981450	0.258450	0.344800	0.0000	0.068920	0.258450	0.0000	4.686580	0.310140
281 91-89	9.6100	1.239700	0.161700	0.215800	0.0000	0.043120	0.161700	0.0000	2.932160	0.194040
282 92-84	6.7300	1.723850	0.224850	0.298800	0.0000	0.059960	0.224850	0.0000	4.077280	0.269820
283 93-81	17.4900	1.542150	0.201150	0.268200	0.0000	0.053640	0.201150	0.0000	3.647520	0.241380
284 94-92	5.8700	2.358850	0.307850	0.410200	0.0000	0.082040	0.307850	0.0000	5.578720	0.369180
285 95-98	0.0000	1.258950	0.163950	0.218800	0.0000	0.043720	0.163950	0.0000	2.972980	0.196740
286 96-78	0.0000	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
287 97-82	0.0000	2.108120	0.274973	0.368531	0.0000	0.073328	0.274973	0.0000	4.986176	0.329967
288 98-79	0.0000	2.126350	0.277350	0.369800	0.0000	0.073960	0.277350	0.0000	5.029280	0.332820
289 99-78	0.0000	1.229350	0.160350	0.213800	0.0000	0.042760	0.160350	0.0000	2.907680	0.192420
290 100-93	0.0000	1.271900	0.165900	0.221200	0.0000	0.044240	0.165900	0.0000	3.009320	0.199080
291 101-80	17.0700	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
292 102-87	16.8900	2.130950	0.277950	0.370600	0.0000	0.074120	0.277950	0.0000	5.040160	0.333540
293 103-83	14.5800	0.000000	0.000000	0.000000	0.0000	0.000000	0.000000	0.0000	0.000000	0.000000
294 SRL-165NR	7.1200	0.000000	0.030000	1.520000	0.0000	0.090000	0.000000	0.0000	0.030000	0.600000
295 WY205NR	9.9600	0.000000	0.120000	3.120000	0.9700	3.510000	0.100000	0.0000	2.520000	0.000000
296 UK209	10.8800	0.000000	0.310000	1.260000	0.0000	0.000000	0.500000	0.0000	0.000000	1.720000
297 SRL-131	9.8400	1.620000	0.140000	0.310000	0.7500	0.120000	0.300000	0.0000	0.100000	0.450000

# Glass	22 BaO	23 PbO	24 ThO2	25 28-D NSI (g/m ²)	26 pH	27 St. Ghyl (KC/Mol)	28 Jantzen's St. Ghyl	29 Ghyl (KC/Mol)	30 Jantzen's Ghyl
271 81-34	0.0000	0.0000	2.989100	13.500000	8.500000	-10.314835	-7.167023	-10.445685	-7.297873
272 82-24	0.0000	0.0000	8.191200	271.300000	10.900000	-19.333386	-12.599991	-23.038363	-16.304989
273 83-8	0.0000	0.0000	0.000000	198.900000	10.200000	-7.177283	-5.641478	-9.192643	-7.658838
274 84-51	0.0000	0.0000	5.435050	67.200000	8.900000	-6.100043	-5.067136	-8.395294	-5.362386
275 85-16	0.0000	0.0000	0.000000	7.600000	8.800000	-7.516454	-4.925686	-7.552721	-4.961854
276 86-88	0.0000	0.0000	0.000000	68.700000	12.400000	-7.761089	-5.620676	-11.795336	-9.644923
277 87-86	0.0000	0.0000	2.105150	11.600000	11.200000	-21.775126	-11.506035	-23.531558	-13.262467
278 88-91	0.0000	0.0000	2.172800	34.200000	10.600000	-12.524177	-7.950364	-15.457535	-10.883721
279 89-77	0.0000	0.0000	0.000000	5.700000	8.900000	-2.572116	-2.199945	-2.867367	-2.495198
280 90-85	0.0000	0.0000	6.116650	12.900000	9.900000	-8.687779	-5.892046	-9.036209	-6.240477
281 91-89	0.0000	0.0000	3.828900	8.800000	8.900000	-5.392197	-4.342957	-5.687448	-4.638287
282 92-84	0.0000	0.0000	5.321450	13.000000	9.700000	-10.315252	-7.275800	-11.422965	-8.383513
283 93-81	0.0000	0.0000	4.760550	63.200000	9.400000	-8.942820	-6.700097	-9.655498	-7.412776
284 94-92	0.0000	0.0000	7.281050	6.600000	9.600000	-8.161145	-6.241744	-9.124432	-7.205031
285 95-90	0.0000	0.0000	3.880150	8.900000	9.200000	-9.067690	-6.152704	-9.154969	-6.239983
286 96-76	0.0000	0.0000	0.000000	79.800000	11.700000	-14.061069	-8.500507	-16.651057	-11.070495
287 97-82	0.0000	0.0000	6.507692	7.227877	1.693299	-16.460432	-9.861898	-16.460432	-9.861898
288 98-79	0.0000	0.0000	6.563950	39.300000	11.100000	-13.381584	-8.838050	-14.993470	-10.449937
289 99-78	0.0000	0.0000	3.794950	11.800000	10.100000	-7.236762	-4.986703	-7.723683	-5.473625
290 100-93	0.0000	0.0000	3.926300	6.400000	9.200000	-3.259098	-2.525318	-3.348371	-2.612597
291 101-80	0.0000	0.0000	0.000000	8.700000	9.500000	-8.494814	-6.092328	-9.326453	-6.923067
292 102-87	0.0000	0.0000	6.578150	5.300000	8.500000	-4.906344	-4.239497	-5.037194	-4.370346
293 103-83	0.0000	0.0000	0.000000	29.600000	10.200000	-12.658976	-8.389482	-14.674335	-10.404822
294 SRL-105NR	0.1100	0.1100	0.000000	14.320000	10.000000	-6.019849	-4.367263	-7.638421	-5.983836
295 WV205NR	0.0600	0.0600	0.000000	16.320000	9.780000	-7.328469	-5.293298	-8.560900	-6.525728
296 UK209	0.3700	0.0000	0.000000	12.600000	9.400000	-5.584569	-4.076383	-6.297247	-4.789062
297 SRL-131	0.0100	0.0000	0.000000	24.330000	10.100000	-10.433845	-7.038168	-12.244196	-8.848517

Ø Glass	31 NBO	32 Val. Par.	33
271 81-34	0.543334	-0.458919	2.602890
272 82-24	0.824230	0.008376	5.603226
273 83-8	0.422591	-0.413539	5.292802
274 84-51	0.305876	-0.592646	4.207673
275 85-16	0.388634	-0.680580	2.028148
276 86-88	0.398639	-0.389897	4.229749
277 87-88	0.843012	-0.252875	2.451005
278 88-91	0.745345	-0.517704	3.632226
279 89-77	0.012297	-0.653567	1.740486
280 90-85	0.652157	-0.675439	2.557227
281 91-89	0.194802	-0.584977	2.174752
282 92-84	0.592987	-0.479891	2.564949
283 93-81	0.594508	-0.612852	4.146304
284 94-92	0.579849	-0.499831	1.887070
285 95-90	0.447469	-0.608282	2.186051
286 96-76	0.788861	-0.358905	4.379524
287 97-82	0.930382	-0.406982	1.977945
288 98-79	0.727213	-0.282310	3.671225
289 99-78	0.559821	-0.670771	2.468100
290 100-93	0.372490	-0.749792	1.856298
291 101-80	0.408994	-0.651775	2.163323
292 102-87	0.248326	-0.707323	1.667707
293 103-83	0.670573	-0.378738	3.387774
294 SRL-105NR	0.420819	-0.443201	2.661667
295 WV205NR	0.481790	-0.462581	2.792391
296 UK209	0.425780	-0.582585	2.533697
297 SRL-131	0.538022	-0.304210	3.191710

APPENDIX D

ACCUMULATED DATA ON CANISTER CORROSION

TABLE D.1. Corrosion Rates of Iron and Mild Steels in Low Ionic Strength Waters

Material	Type of Water	Temp., °C	pH At R. T.	Inlet Oxygen, ppm	Chloride, ppm	Test Duration, days	Corrosion Rate, mm/yr	Reference	Comments
Carbon Steel	Groundwater	?	5-9	8	?	Calc.	0.0003	28	no temp
Carbon Steel	Syn. Groundwater	?	5-9	0	?	125	0.0008	28	
Carbon Steel	Syn. Groundwater	?	5-9	8	?	Calc.	0.03	28	radn.
(Also see G. P. Marsh, Nucl Energy, 21, 4, 253, August 1983)									
Gray Iron	Simulated Hanford	250	9.9	<1	312	90	0.01 to 0.02	Westerman (1980) Pitman (1980)	Welded U-bends
Gray Iron	Simulated Hanford	250	9.9	<1	312	180	0.03	Westerman (1980) Pitman (1980)	Welded U-bends
Ductile Iron	Basalt G.W.	250	9.9	6-8	312	30	0.025	Westerman, PNL-4452	
Ductile Iron	Basalt G.W.	250	9.9	6-8	312	90	0.018	Westerman, PNL-4452	
Ductile Iron	Basalt G.W.	250	9.9	6-8	312	180	0.0065	Westerman, PNL-4452	
Ductile Iron	Basalt G.W.	150	9.9	6-8	312	30	0.000	Westerman, PNL-4452	
Ductile Iron	Basalt G.W.	150	9.9	6-8	312	90	0.004	Westerman, PNL-4452	
Ductile Iron	Basalt G.W.	150	9.9	6-8	312	180	0.004	Westerman, PNL-4452	
Ductile Cast Iron	Simulated Hanford	250	9.9	<1	312	90	0.02	Westerman (1980) Pitman (1980)	Welded U-bends
Ductile Cast Iron	Simulated Hanford	250	9.9	<1	312	180	0.02 to 0.03	Westerman (1980) Pitman (1980)	Welded U-bends
Ductile Cast Iron	Syn. Grande Ronde	150	9.9±0.1	6-8	312	30	0.008±0.001	Westerman et al. (1982)	no pits
Ductile Cast Iron	Syn. G.R.	150	9.9±0.1	6-8	312	90	0.0038	Westerman et al. (1982)	no pits
Ductile Cast Iron	Syn. G.R.	150	9.9±0.1	6-8	312	180	0.0036	Westerman et al. (1982)	no pits
Ductile Cast Iron	Syn. G.R.	250	9.9±0.1	6-8	312	30	0.025±0.001	Westerman et al. (1982)	no pits
Ductile Cast Iron	Syn. G.R.	250	9.9±0.1	6-8	312	90	0.0079	Westerman et al. (1982)	no pits
Ductile Cast Iron	Syn. G.R.	250	9.9±0.1	6-8	312	180	0.006±0.001	Westerman et al. (1982)	no pits

TABLE D.1. (contd)

Material	Type of Water	Temp., °C	pH At R. I.	Inlet Oxygen, ppm	Chloride, ppm	Test Duration, days	Corrosion Rate, mm/yr	Reference	Comments
Ductile Cast Iron	J-13 (luff G.W.)	250	7.9±0.6	6-8	6.4	30	0.0016±0.001	Westerman et al. (1982)	no pits
Ductile Cast Iron	DIM	250	7.0	0	0	30	0.010±0.0004	Westerman et al. (1982)	no pits
Ductile Cast Iron	DIM	250	7.0	0	0	90	0.0077±0.0001	Westerman et al. (1982)	no pits
Hrought 1018 Steel	Syn. G.R.	250	9.9	de aer.	312	40	0.0022	INUREG/CR3427	0.017 mm
Hrought 1018 Steel	Con. 10 x G.R.	250	9.9	de aer.	3120	40	0.0064	INUREG/CR3427	0.025 mm
Cast 1018 Steel	Syn. G.R.	250	9.9	de aer.	312	40	0.0016	INUREG/CR3427	mix pit 0.009 mm
Cast 1018 Steel	Con. 10 x G.R.	250	9.9	de aer.	3120	40	0.0056	INUREG/CR3427	0.030 mm
Cast Steel, 2.5 Cr, 1.0 Mo	Syn. G.R.	150	9.9±0.1	6-8	312	30	0.0033	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	Syn. G.R.	150	9.9±0.1	6-8	312	90	0.0020	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	Syn. G.R.	150	9.9±0.1	6-8	312	180	0.0018±0.0007	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	Syn. G.R.	250	9.9±0.1	6-8	312	30	0.0145±0.0005	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	Syn. G.R.	250	9.9±0.1	6-8	312	90	0.0041	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	Syn. G.R.	250	9.9±0.1	6-8	312	180	0.0022±0.0007	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	J-13 (luff G.W.)	250	7.9±0.6	6-8	6.4	30	0.0059±0.0006	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	DIM	250	7.0	0	0	30	0.0124±0.0012	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	DIM	250	7.0	0	0	90	0.0102	Westerman et al. (1982)	no pits
Cast Steel, 1.25 Cr, 0.5 Mo	Syn. G.R.	150	9.9±0.1	6-8	312	30	0.0109±0.0009	Westerman et al. (1982)	no pits
Cast Steel, 1.25 Cr, 0.5 Mo	Syn. G.R.	150	9.9±0.1	6-8	312	90	0.0025	Westerman et al. (1982)	no pits
Cast Steel, 1.25 Cr, 0.5 Mo	Syn. G.R.	150	9.9±0.1	6-8	312	180	0.0027±0.0003	Westerman et al. (1982)	no pits
Cast Steel, 1.25 Cr, 0.5 Mo	Syn. G.R.	250	9.9±0.1	6-8	312	30	0.0195±0.0055	Westerman et al. (1982)	no pits
Cast Steel, 1.25 Cr, 0.5 Mo	Syn. G.R.	250	9.9±0.1	6-8	312	90	0.0043	Westerman et al. (1982)	no pits
Cast Steel, 1.25 Cr, 0.5 Mo	Syn. G.R.	250	9.9±0.1	6-8	312	180	0.0038±0.002	Westerman et al. (1982)	no pits

TABLE D.1. (contd)

Material	Type of Water	Temp., °C	pH At R. T.	Inlet Oxygen, ppm	Chloride, ppm	Test Duration, days	Corrosion Rate, mm/yr	Reference	Comments
Cast Steel, 1.25 Cr, 0.5 Mo	J-13 (tuff)	250	7.9±0.6	6-8	6.4	30	0.0097±0.005	Westerman et al. (1982)	no pits
Cast Steel, 1.25 Cr, 0.5 Mo	DIW	250	7.0	0	0	30	0.0112	Westerman et al. (1982)	no pits
Cast Steel, 1.25 Cr, 0.5 Mo	DIW	250	7.0	0	0	90	0.007±0.0003	Westerman et al. (1982)	no pits
<u>With Radiation (2.10⁵ R/hr Co⁶⁰)</u>									
Ductile Cast Iron	Syn. G.R.	250	9.9±0.1	8	312	70	0.013±0.001	Westerman et al. (1982)	no pits
Ductile Cast Iron	Syn. G.R.	250	9.9±0.1	8	312	90	0.020±0.011	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	Syn. G.R.	250	9.9±0.1	8	312	30	0.0003±0.0006	Westerman et al. (1982)	no pits
Cast Steel, 2.5 Cr, 1.0 Mo	Syn. G.R.	250	9.9±0.1	8	312	90	0.018±0.004	Westerman et al. (1982)	no pits

TABLE D.2. Corrosion Rates of Iron and Mild Steels in Salt, Brine, and Other Saline Waters

Material	Type of Water	Temp., °C	pH at R.T.	Inlet Oxygen, ppm	Chloride, ppm	Test Duration, days	Corrosion Rate, mm/yr	Reference	Comments
Carbon Steel	99.5% NaCl+0.5% H ₂ O	200			sat'd	30	0.033	Clark (1967)	pits 0.046
ASTM A108	99.5% NaCl+0.5% H ₂ O	300			sat'd	30	0.038	Clark (1967)	pits 0.066
ASTM A108	99.75% NaCl+0.24% MgCl ₂	200			sat'd	30	0.069	Clark (1967)	
ASTM A108	99.75% NaCl+0.24% MgCl ₂	300			sat'd	30	0.089	Clark (1967)	
1018 Steel	Brine A	25	6.5	Deoxygen	190,000	28	0.03	Brathwaite et al. (1980)	
1018 Steel	Brine A	70	6.5	Deoxygen	190,000	28	0.07	Brathwaite et al. (1980)	
1018 Steel	Brine A	250	6.5	Deoxygen	190,000	28	1.7	Brathwaite et al. (1980)	
1018 Steel	Brine B	25	6.5	Deoxygen	175,000	28	0.03	Brathwaite et al. (1980)	
1018 Steel	Brine B	70	6.5	Deoxygen	175,000	28	0.036	Brathwaite et al. (1980)	
1018 Steel	Brine B	250	6.5	Deoxygen	175,000	28	0.07	Brathwaite et al. (1980)	
1018 Steel	Seawater	250	8.1	Deoxygen	19,000	28	0.4	Brathwaite et al. (1980)	
1018 Steel	Brine A	250	6.5	600	190,000	28	7.0	Brathwaite et al. (1980)	
1018 Steel	Seawater	250	8.1	1750	19,000	28	11.0	Brathwaite et al. (1980)	
Corten A Steel	Brine A	250	6.5	Deoxygen	190,000	28	0.9	Brathwaite et al. (1980)	
Corten A Steel	Brine B	250	6.5	Deoxygen	175,000	28	0.05	Brathwaite et al. (1980)	
2.25 Cr-1 Ni	Seawater	250	8.1	Deoxygen	19,000	28	0.2	Brathwaite et al. (1980)	
2.25 Cr-1 Ni	Brine A	250	6.5	Deoxygen	190,000	28	1.0	Brathwaite et al. (1980)	Crevice Corrosion
2.25 Cr-1 Ni	Brine B	250	6.5	Deoxygen	175,000	28	0.1	Brathwaite et al. (1980)	Crevice Corrosion

(a) No crevice corrosion or stress corrosion cracking observed, but pitting was detected. Weld and nonweld comparable.

(b) No stress corrosion cracking observed, but severe crevice corrosion and pitting detected in aerated water. Weld and nonweld comparable.

TABLE D.2. (contd)

Material	Type of Water	Temp., °C	pH at R.T.	Inlet Oxygen, ppm	Chloride, ppm	Test Duration, days	Corrosion Rate, mm/yr	Reference	Comments
Ductile Cast Iron	Brine A	250	6.5	oxic	190,000	60	1.39-1.95	Hesterman (1980)	U-bends
Cast Iron	Brine A	150	6.5	0	190,000	360	0.129:0.004	21	no pits
Cast Iron	Seawater	25	8.1	oxic	19,000	6000	0.25	Southwell (1969)	
Cast Steel	Seawater	25	8.1	oxic	19,000	6000	0.20	Southwell (1969)	
Steel	Seawater	25	8.1	oxic	19,000	100	0.10	Kress (1953)	
Steel	Seawater	25	8.1	oxic	19,000	365	0.11	Paris et al. (1957)	
Steel	Seawater	25	8.1	oxic	19,000	220	0.084	Spidel et al. (1960)	
Gray Iron	Seawater	25	8.1	oxic	19,000	730	0.061	Hudson (1950)	
Gray Iron	Seawater	25	8.1	oxic	19,000	180	0.086	Kress (1953)	
Gray Iron	Seawater	25	8.1	oxic	19,000	365	0.086	Paris et al. (1957)	
Gray Iron	Seawater	25	8.1	oxic	19,000	220	0.030	Spidel et al. (1960)	
Gray Iron	Seawater	25	8.1	oxic	19,000	1000	0.81	La Que (1959)	pits
White Iron	Seawater	25	8.1	oxic	19,000	220	0.043	Spidel et al. (1960)	
Ductile Iron	Seawater	25	8.1	oxic	19,000	730	0.079	Hudson (1950)	
Ductile Iron	Seawater	25	8.1	oxic	19,000	220	0.043	Spidel et al. (1960)	
Pearlitic Nodular C.I.	Seawater	25	8.1	oxic	19,000	180	0.051	Kress (1953)	
Pearlitic Nodular C.I.	Seawater	25	8.1	oxic	19,000	220	0.071	Spidel et al. (1960)	
Pearlitic Nodular C.I.	Seawater	25	8.1	oxic	19,000	1000	0.28	La Que (1959)	pits

(a) No crevice corrosion or stress corrosion cracking observed, but pitting was detected. Weld and nonweld comparable.

(b) No stress corrosion cracking observed, but severe crevice corrosion and pitting detected in aerated water. Weld and nonweld comparable.

TABLE D.2. (contd)

Material	Type of Water	Temp., °C	pH at R.T.	Inlet Oxygen, ppm	Chloride, ppm	Test Duration, days	Corrosion Rate, mm/yr	Reference	Comments
Ferritic Steel	Seawater	25	8.1	oxic	19,000	180	0.11	Kress (1953)	
Ferritic Steel	Seawater	25	8.1	oxic	19,000	365	0.082	Paris et al. (1957)	
Ferritic Steel	Seawater	25	8.1	oxic	19,000	220	0.026	Speidel et al. (1960)	
1020 Carbon Steel	Salton Sea Brine	105	6.1	Deaerated	140,000	15	0.106	Cramer et al. (1980)	Flowing
1020 Carbon Steel	Salton Sea Brine	105	6.1	Aerated (100)	140,000	15	0.147	Cramer et al. (1980)	Flowing
1020 Carbon Steel	Salton Sea Brine	232	6.1	Deaerated	140,000	15	0.419 ^(a)	Cramer et al. (1980)	Flowing
1020 Carbon Steel	Salton Sea Brine	232	6.1	Aerated (100)	140,000	15	26.92 ^(a)	Cramer et al. (1980)	Flowing
1-Brite 26-1	Salton Sea Brine	105	6.1	Deaerated	140,000	15	0.000	Cramer et al. (1980)	Flowing
1-Brite 26-1	Salton Sea Brine	105	6.1	Aerated (100)	140,000	15	0.091	Cramer et al. (1980)	Flowing
1-Brite 26-1	Salton Sea Brine	232	6.1	Deaerated	140,000	15	0.0025 ^(b)	Cramer et al. (1980)	Flowing
1-Brite 26-1	Salton Sea Brine	232	6.1	Aerated (100)	140,000	15	0.508 ^(b)	Cramer et al. (1980)	Flowing
1-Brite 26-1	Mesa 6-1 Brine	152	5.2	low oxygen	11,000	22	0.249	McCawley et al. (1981)	
1-Brite 26-1	Mesa 6-1 Steam	140	5.2	unknown	3-5,000	22	0.422	McCawley et al. (1981)	
Mild Steels	1% NaCl (CO ₂)	150	4.6	<0.01	6,000	14	0.38-0.58	Shannon (1977)	Low Flow
Mild Steels	1% NaCl (CO ₂ +H ₂ S)	150	4.6	<0.01	6,000	14	0.28-0.53	Shannon (1977)	Low Flow
Mild Steels	1% NaCl (CO ₂ +SiO ₂)	150	4.6	<0.01	6,000	14	0.36-0.41	Shannon (1977)	Low Flow
A-570 Steel	1% NaCl	250	4.7±0.1	<0.01	6,000	14	0.3	Shannon (1977)	Low Flow
A-570 Steel	5% NaCl	250	4.7±0.1	<0.01	30,000	14	0.9	Shannon (1977)	Low Flow
A-570 Steel	10% NaCl	250	4.7±0.1	<0.01	60,000	14	1.1	Shannon (1977)	Low Flow
A-570 Steel	20% NaCl	250	4.7±0.1	<0.01	120,000	14	2.8	Shannon (1977)	Low Flow

(a) No crevice corrosion or stress corrosion cracking observed, but pitting was detected. Weld and nonweld comparable.

(b) No stress corrosion cracking observed, but severe crevice corrosion and pitting detected in aerated water. Weld and nonweld comparable.

TABLE D.2. (contd)

Material	Type of Water	Temp., °F.	pH at R.T.	Inlet Oxygen, ppm	Chloride, ppm	Test Duration, days	Corrosion Rate, mm/yr	Reference	Comments
A516 Steel	1% NaCl	250	4.7±0.1	<0.01	6,000	14	0.3	Shannon (1977)	Low Flow
A530 Steel	5% NaCl	250	4.7±0.1	<0.01	30,000	14	0.6	Shannon (1977)	Low Flow
A530 Steel	10% NaCl	250	4.7±0.1	<0.01	60,000	14	0.9	Shannon (1977)	Low Flow
A530 Steel	20% NaCl	250	4.7±0.1	<0.01	120,000	14	2.8	Shannon (1977)	Low Flow
C75 Steel	1% NaCl	250	4.7±0.1	<0.01	6,000	14	0.2	Shannon (1977)	Low Flow
C75 Steel	5% NaCl	250	4.7±0.1	<0.01	30,000	14	0.4	Shannon (1977)	Low Flow
C75 Steel	10% NaCl	250	4.7±0.1	<0.01	60,000	14	0.2	Shannon (1977)	Low Flow
C75 Steel	20% NaCl	250	4.7±0.1	<0.01	120,000	14	2.0	Shannon (1977)	Low Flow
1010 Steel	1% NaCl	250	4.7±0.1	<0.01	6,000	14	0.4	Shannon (1977)	Low Flow
1010 Steel	5% NaCl	250	4.7±0.1	<0.01	30,000	14	1.0	Shannon (1977)	Low Flow
1010 Steel	10% NaCl	250	4.7±0.1	<0.01	60,000	14	1.0	Shannon (1977)	Low Flow
1010 Steel	20% NaCl	250	4.7±0.1	<0.01	120,000	14	3.5	Shannon (1977)	Low Flow
2.25 Cr-1Mo	1% NaCl	250	4.7±0.1	<0.01	6,000	14	0.08	Shannon (1977)	Low Flow
2.25 Cr-1Mo	5% NaCl	250	4.7±0.1	<0.01	30,000	14	0.6	Shannon (1977)	Low Flow
2.25 Cr-1Mo	10% NaCl	250	4.7±0.1	<0.01	60,000	14	0.3	Shannon (1977)	Low Flow
2.25 Cr-1Mo	20% NaCl	250	4.7±0.1	<0.01	120,000	14	1.8	Shannon (1977)	Low Flow
E-Brille 26-1	1% NaCl	250	4.7±0.1	<0.01	6,000	14	0.05	Shannon (1977)	Low Flow
E-Brille 26-1	5% NaCl	250	4.7±0.1	<0.01	30,000	14	0.01-0.02	Shannon (1977)	Low Flow
E-Brille 26-1	10% NaCl	250	4.7±0.1	<0.01	60,000	14	0.02	Shannon (1977)	Low Flow
E-Brille 26-1	20% NaCl	250	4.7±0.1	<0.01	120,000	14	0.05±0.03	Shannon (1977)	Low Flow

(a) No crevice corrosion or stress corrosion cracking observed, but pitting was detected. Weld and nonweld comparable.

(b) No stress corrosion cracking observed, but severe crevice corrosion and pitting detected in aerated water. Weld and nonweld comparable.

TABLE D.2. (contd)

Material	Type of Water	Temp., °C	pH at R.T.	Inlet Oxygen, ppm	Chloride, ppm	Test Duration, days	Corrosion Rate, mm/yr	Reference	Comments
Avg of 10 Steels	1% NaCl (H ₂ S)	250	4.8	<0.01	6,000	14	0.18	Shannon (1977)	Low Flow
Avg of 10 Steels	20% NaCl	250	4.6	<0.01	120,000	14	2.2	Shannon (1977)	Low Flow
2.25 Cr-1Mo	1% NaCl (H ₂ S)	250	4.8	<0.01	6,000	14	0.00	Shannon (1977)	Low Flow
2.25 Cr-1Mo	20% NaCl	250	4.6	<0.01	120,000	14	0.48	Shannon (1977)	Low Flow
E-Brite 26-1	1% NaCl (H ₂ S)	250	4.8	<0.01	6,000	14	0.02	Shannon (1977)	Low Flow
E-Brite 26-1	20% NaCl	250	4.6	<0.01	120,000	14	0.02	Shannon (1977)	Low Flow
With Radiation 10 ⁵ to 10 ⁷ R/h Co ⁶⁰									
1010 Steel	Seawater	90	6.1	unknown	19,000	49	0.03@10 ⁵ R/h	Molecke et al. (1981)	
1018 Steel	Brine A	90	6.5	unknown	190,000	49	0.1@10 ⁵ R/h	Molecke et al. (1981)	
1018 Steel	Brine A	90	6.5	unknown	190,000	79	1@10 ⁷ R/h	Molecke et al. (1981)	
1018 Steel	Brine B	90	6.5		175,000	79	1@10 ⁷ R/h	Molecke et al. (1981)	

(a) No crevice corrosion or stress corrosion cracking observed, but pitting was detected. Weld and nonweld comparable.

(b) No stress corrosion cracking observed, but severe crevice corrosion and pitting detected in aerated water. Weld and nonweld comparable.

TABLE D.3. Composition of Groundwaters for Various Geologic Media

Component	Seawater (Braithwaite and Molecke 1978)	Tuff, Nevada (Wolfsberg et al. 1979)	GR Basalt, Hanford (Wood 1980)	Shale, Nevada (Doesch and Lynch 1979)	Granite, Sierra (Erdal et al. 1979)	Brine A, WIPP (Braithwaite and Molecke 1978)	Brine B, WIPP (Braithwaite and Molecke 1978)
Na ⁺	10,651	50.2	358	30	7	42,000	115,000
K ⁺	380	4.9	3.4	7	2	30,000	15
Mg ⁺²	1,272	2	0.032	25	2	35,000	10
Ca ⁺²	400	14.2	2.8	79	8	600	900
Sr ⁺² 13	0.045		0.4		5	15	
Cl ⁻	10,980	6.4	312	13	2	190,000	175,000
SO ₄ ⁻²	884	10	172	62	3	3,500	3,500
I ⁻	0.05					10	10
HCO ₃ ⁻	146	130	55	280		700	10
Br ⁻	65					400	400
BO ₃ ⁻³						1,200	10
Ba		0.004					
Li		0.06					
H ₃ SiO ₄ ⁻			120				
F ⁻		2	33	0.6			
CO ₃ ⁻²			27				
Fe ⁺³		0.039		0.03			
Si		29 - 37		31	13		
NO ₃ ⁻		9					
pH (RT)	8.1	7.3 - 8.4	9.9	7.2	8	6.5	6.5

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