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AREA REDUCTION
MEASUREMENTS OF
FRACTURED TENSILE SPECIMENS

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NUCLEAR AEROSPACE RESEARCH FACILITY

**AREA REDUCTION MEASUREMENTS
OF
FRACTURED TENSILE SPECIMENS**

Prepared for
AEROJET-GENERAL CORPORATION
SACRAMENTO, CALIFORNIA

AGC PO Number NP-000128, Item 3

GENERAL DYNAMICS
Fort Worth Division

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SUMMARY

Magnified photographs were taken of selected AGC fractured tensile test specimens located at NARF. The specimens were from GTR-16 and previous tests. Cross-sectional areas of the fractured edges of the specimens were then measured with a planimeter, reduced by the magnification factor, and recorded.

A total of 140 specimens were photographed and measured. The specimens were fabricated from the following materials:

- A-286
- Al-356-T6
- Al-6061-T6
- Al-7075-T6
- Hastelloy C
- Inconel 713-C
- Inconel X-750
- SS-347-C
- Ti-A-110-AT

An average of four measurements was used to determine the fractured areas. All data obtained in the tests are shown in Table 3.1.

I. INTRODUCTION

Both the original cross-sectional area of untested specimens and the reduced cross-sectional area of fractured specimens were determined previously for all AGC specimens located at NARF. This data, which were obtained with a micrometer, were submitted previously to AGC in accordance with contractual requirements.

More accurate values of the reduced cross-sectional areas are now required by AGC and were obtained in this test. The approach involved taking a magnified photograph of the fractured edge of the specimen, and measuring its cross-sectional area with a planimeter.

II. TEST PROCEDURES

The specified tensile test specimens were removed from storage and prepared for photography. The two halves, when both were available, were taped together to allow the two fractured edges to be adjacent in the photograph. A Bausch & Lomb Optical Co., Model L, camera was utilized, employing a 4 x 5 Polaroid film holder. Type 57 Polaroid film was used. An optimum camera setting to allow full use of the exposure surface was determined and secured. The resulting magnification factor ranged from 7.15 to 7.18. Included in each photograph was a scale having 0.01-in. increments. The magnification factor was verified, using the photographed scale, for each specimen. The camera setting remained constant during all photographs; however, some focusing was required due to some extreme angles of specimen fracture.

Mr. John Bauer, Aerojet General Corporation, reviewed each photo as it was obtained, recorded the individual specimen number on the print, and made other notations as needed.

Area measurements were accomplished by use of a planimeter, Keuffel & Esser Co., Model 4236. Two measurements of each half were made and an average of the four values obtained. To ensure good accuracy in the measurements, the planimeter tracing was viewed through a 2-power magnifying glass.

The average area, as measured, was reduced by the photograph magnification factor to yield the correct fractured area of each individual test specimen.

III. TEST RESULTS

The reduced cross-sectional areas of the specimens were determined and values are tabulated in Table 3.1. The test specimens are grouped in the table by material. The reported areas are an average of four measurements.

Table 3.1

Reduced Cross- Sectional Areas of Tensile Specimens

Material and Specimen No.	Reduced Cross-Sectional Area (in ²)	Material and Specimen No.	Reduced Cross-Sectional Area (in ²)
<u>6061-T6</u>		<u>6061-T6</u>	
2-74	.0281	3-118	.0260
2-77	.0307	3-119	.0260
2-78	.0295	3-120	.0271
2-79	.0311	3-265	.0370
2-80	.0293	3-267	.0300
2-84	.0281	3-268	.0302
3-25	.0301	3-269	.0332
3-26	.0299	3-275	.0378
3-27	.0339	3-281	.0382
3-28	.0306	3-283	.0370
3-29	.0360	3-285	.0361
3-30	.0350	R-82	.0267
3-31	.0313	R-83	.0278
3-32	.0349	R-84	.0404
3-33	.0346	717	.0413
3-34	.0336	718	.0417
3-35	.0366	719	.0414
3-36	.0321	720	.0413
3-73	.0316	724	.0418
3-74	.0311	725	.0398
3-75	.0304	726	.0430
3-76	.0310	760	.0436
3-77	.0407	761	.0281
3-78	.0366		
3-79	.0385	<u>7075-T6</u>	
3-80	.0342	2-101	.0413
3-82	.0383	2-102	.0404
3-83	.0383	2-104	.0438
3-97	.0239	2-105	.0418
3-98	.0271	2-106	.0413
3-99	.0243	2-107	.0418
3-100	.0259	2-108	.0414
3-101	.0338		
3-102	.0289	<u>A-356</u>	
3-106	.0286	2-1	.0443
3-115	.0264	2-2	.0442
3-116	.0263	2-3	.0438
3-117	.0274	2-4	.0439

(Table Cont'd)

Table 3.1 (Cont'd)

Material and Specimen No.	Reduced Cross-Sectional Area (in ²)	Material and Specimen No.	Reduced Cross-Sectional Area (in ²)
<u>A-356</u>		<u>SS 347</u>	
2-5	.0443	2-173	.0393
2-6	.0428	2-174	.0410
2-8	.0442	2-175	.0400
2-9	.0442	2-177	.0399
2-10	.0428	2-178	.0414
2-11	.0441	2-179	.0434
		2-180	.0424
<u>A-110</u>		3-197	.0272
2-280	.0256	3-198	.0256
2-281	.0389	3-199	.0363
2-282	.0361	3-200	.0268
2-284	.0368	3-201	.0281
2-285	.0389	3-202	.0270
2-286	.0356	3-204	.0272
2-287	.0352	701	.0293
2-288	.0352	703	.0302
2-293	.0398	704	.0304
2-294	.0399		
2-295	.0410	<u>A-286</u>	
2-297	.0385	2-205	.0335
2-299	.0428	2-207	.0285
2-300	.0431	2-208	.0272
		2-209	.0282
<u>Inconel</u>		2-210	.0278
<u>X750</u>		2-211	.0300
2-377	.0325	2-213	.0291
2-378	.0313	2-214	.0297
2-379	.0316	2-215	.0329
2-380	.0328	2-216	.0295
2-381	.0309		
2-382	.0318	<u>Hastelloy</u>	
2-383	.0313	<u>C</u>	
		2-353	.0309
<u>Inconel</u>		2-354	.0267
<u>713-C</u>		2-355	.0313
2-401	.0320	2-356	.0296
2-402	.0449	2-357	.0268
2-403	.0418	2-358	.0325
2-404	.0371	2-360	.0263
2-405	.0423		
2-406	.0427		
2-407	.0403		

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