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THE RELATIVE THERMAL CONDUCTIVITIES OF LIQUID
LITHIUM, SODIUM, AND EUTECTIC NaK, AND THE
SPECIFIC HEAT OF LIQUID LITHIUM

by

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INTRODUCTION

Literature values for the thermal conductivity and specific heat of liquid lithium do not appear to be reliable. Dependable estimates of these quantities are desirable since both the thermal conductivity and the specific heat appear in certain dimensionless groups that play an important part in heat-transfer calculations.

Determinations of the relative thermal conductivities of liquid lithium, sodium, and eutectic NaK under similar conditions show that lithium is not as efficient a heat-transfer medium as sodium, and is more efficient than eutectic NaK. The present determinations were made in a simple conductivity apparatus designed by S. Untermeyer. For a mean liquid temperature of 190°C to 200°C the value obtained for the thermal conductivity of sodium is in fair agreement with published values. The relative conductivities of lithium and NaK are roughly 1/2 and 1/4 that of sodium in the neighborhood of 250°C.

The values for the specific heat of liquid lithium reported independently by Mine Safety Appliance Company (MSA) and NEPA, and the values given in the tables of Landolt-Boernstein show a decreasing specific heat with increasing temperature. Recent determinations at ANL, however, show an increase in the specific heat of liquid lithium with an increase in temperature, although the numerical values are of the same order of magnitude as those reported by the ^{from other} above-mentioned sources. These more recent specific heat values were calculated from a comparison of the cooling rates in air of aluminum-filled and lithium-filled stainless steel capsules. The numerical values reported for lithium are believed to have an accuracy of about $\pm 10\%$.

THE RELATIVE THERMAL CONDUCTIVITIES OF LIQUID
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F. L. Yaggee and Samuel Untermeyer

RELATIVE THERMAL CONDUCTIVITIES OF LIQUID LITHIUM,
SODIUM AND EUTECTIC NaK

Apparatus and General Technique

The thermal conductivities were determined by the well known method of measuring the temperature difference along the length of a liquid column of constant cross-section when the heat input is known.

Figure 1 shows the insulated apparatus as it looked while the measurements were in progress. The liquid metal whose thermal conductivity was to be measured was held in a thin wall stainless steel tube 7 inches long, having a 3/4-inch outside diameter and a 0.033-inch wall thickness. The upper end of the tube was effectively sealed with a 1/4-inch standard pipe plug. To minimize convection within the liquid column heat was supplied to the liquid metal at the top of the column by means of a nichrome resistance winding, and was extracted at the bottom of the column through a heat sink. The two-inch interval of length across which the temperature gradient of the liquid metal column was measured was located at the lower end of the thin wall tube near the heat sink. Sauereisen adhesive cement was used as an insulation-covering over the nichrome ribbon winding, and as a means of holding the iron-constantan thermocouples in place once intimate contact was secured between the beads and the wells.

For each determination approximately 40 cc of lithium, sodium or NaK was used, allowing roughly an inch at the top for thermal expansion of the liquid. Care was taken in filling and sealing the apparatus to prevent oxide contamination. Except for the first two tests with lithium and one with sodium the apparatus was kept in a heated drying oven to minimize radiation losses which might otherwise have been too great. D. C. power, obtained from rectified 110 a.c., was used, and the power input was manually controlled with a Variac transformer. The value of the input was arbitrarily adjusted in an effort to obtain a suitable temperature range. The temperature difference (ΔT) and the bottom temperature (T_2) were read directly and simultaneously on separate Leeds and Northrup portable potentiometers using iron-constantan thermocouples. To obtain a direct

FIGURE 1. THERMAL CONDUCTIVITY APPARATUS.

reading of ΔT the two thermocouples were connected with opposing emf's. Current, temperature, and voltage readings were recorded at five minute intervals for each fixed power input until a steady state condition was obtained.

A second similar run was made after the solidified material from the first run had been re-melted.

Methods Used to Fill the Apparatus

Lithium (m.p. 186°C)

A stainless steel bomb containing a weighed amount of solid lithium was fitted to the apparatus as shown in Figure 2, and the entire system was gradually heated and evacuated for 15 to 20 minutes. After several cycles of evacuating and purging with 99.9% pure argon the lithium was melted under vacuum and transferred to the apparatus, by an argon pressure, where it was allowed to solidify. The bomb was removed and the apparatus sealed with a 1/4" standard pipe plug which was painted over with Glyptol.

Sodium (m.p. 97.9°C)

The pressurized stainless steel container with the solid sodium in it was made part of a Pyrex glass system as shown in Figure 3, and the latter was thoroughly evacuated. The sodium was melted by means of a resistance heater and transferred to the Pyrex tube where it was vacuum sealed. Both the vacuum-sealed sodium and the apparatus were put into a dry box which was evacuated and purged several times with 99.9% pure argon before being filled with argon to slightly greater than atmospheric pressure. At this point the notched tip of the Pyrex tube was broken and the sodium was melted and charged into the apparatus where it was permitted to solidify. The apparatus was sealed as in the case with lithium.

Eutectic NaK (m.p. -12.5°C)

The pressurized container of NaK was made a part of a system which included the apparatus and a Pyrex glass bulb as shown in Figure 4, and the entire set-up was thoroughly evacuated and purged with 99.9% pure argon. Pinch joint 2, just below the Pyrex tube, was closed and a measured volume of NaK was transferred to the measuring bulb by opening a valve on the NaK container. Pinch joints 1 and 3 were then closed and a small argon pressure was allowed to build up in the Pyrex bulb, which forced the NaK into the apparatus when the pinch joint at 2 was opened. The rubber stopper was removed from the apparatus and replaced by a 1/4" standard pipe plug and painted over with Glyptol as with the lithium and sodium.

FIGURE 2 LITHIUM CHARGING SYSTEM

FIGURE 3 SODIUM CHARGING SYSTEM

FIGURE 4 NaK CHARGING SYSTEM

Purity of Materials

The maximum purity of the lithium, sodium, and NaK used was no greater than that of the commercial materials, since no effort was made to filter or otherwise purify them. With lithium, however, the liquid was passed through a 1/8" inside diameter tube to remove the visible surface oxide coat of the solid. The surface of each material appeared as bright after the measurements were made as before, indicating that the argon atmosphere within the apparatus and the method of sealing prevented visible oxidation.

The sodium and eutectic NaK are both products of the Mine Safety Appliance Company, and were received in metal containers pressurized with nitrogen. Neither material was chemically analyzed for impurities, but both are stated to be of unusually high purity for commercial products.

The lithium was of a commercial grade manufactured by the Maywood Chemical Company and was received as 2" x 2" x 1" solids packed under oil. It is believed to be the least pure of the three materials tested. Substantial amounts of lithium oxide and nitride are known to be present in addition to small amounts of metallic impurities as indicated by the following spectrochemical analyses.

Table I

SPECTROCHEMICAL ANALYSIS OF COMMERCIAL LITHIUM BEFORE AND AFTER CONDUCTIVITY MEASUREMENTS

(Results in Per cent)

As received before test:

<u>Ca</u>	<u>Si</u>	<u>Hg</u>	<u>P</u>	<u>Al</u>	<u>B</u>	<u>Cr</u>	<u>Cu</u>	<u>Fe</u>	<u>K</u>	<u>Na</u>	<u>Ni</u>
0.1	0.1	<0.1	<0.1	< .01	< .01	< .01	< .01	< .01	< .01	< .01	< .01

After test:

0.1	--	<0.1	<0.1	0.1	0.2	0.02	0.04	--	<0.01	<0.1	<0.01
-----	----	------	------	-----	-----	------	------	----	-------	------	-------

The iron and silicon have been omitted from the "after test" analysis because of some difficulty which yielded erroneous values for these two elements.

Apparatus Calibration and Calculations

The apparatus was calibrated by making a blank run under actual testing conditions while continuously evacuating the container. The calibration data are tabulated in Table II.

Under steady state conditions the rate of heat transfer by thermal conduction through a cross-sectional area per unit time is given by the equation:

$$q = k A \frac{\Delta T}{X}$$

where q = quantity of heat transmitted by thermal conduction per unit time (cal/sec)

k = thermal conductivity [cal/(sec)(sq.cm)(°C per cm)]

A = cross-sectional area (sq.cm)

$\frac{\Delta T}{X}$ = temperature gradient (°C/cm)

For the apparatus:

$$K_1 = \frac{q}{A_1} \cdot \frac{X}{\Delta T}$$

$$K_1 = \frac{\frac{EI}{4.185} \cdot X}{A_1 \Delta T}$$

$$K_1 = \frac{\frac{EI}{4.185} (2)(2.54)}{(0.49) \Delta T}$$

$$K_1 = \frac{2.47 EI}{\Delta T} \quad (1)$$

K_1 = apparent thermal conductivity of the stainless steel.

A_1 = cross-sectional area of the thin wall stainless steel tube.

E = applied emf (volts)

I = current (amperes)

Table II

Apparatus CALIBRATION: $K = \frac{2.47 EI}{\Delta T}$

(Apparatus in heated oven)

$^{\circ}\text{C}$ Furnace Temp.	ΔT $^{\circ}\text{C}$	T_2 $^{\circ}\text{C}$	T_1 $^{\circ}\text{C}$	T_m^* $^{\circ}\text{C}$	E Volts	I Amps	K cal/(sec)(sq.cm)($^{\circ}\text{C}$ per cm)
25.5	---	25.5	25.5	---	4.8	2.0	---
26	69	95	160	125	4.8	2.0	0.344
27	89	130	215	170	4.8	2.0	0.266
28	100	152	246	195	4.8	2.0	0.237
35	104	157	257	203	4.8	2.0	0.228
60	104	172	271	218	4.9	2.0	0.232 **
74	98	184	278	228	4.75	1.95	0.234 **
79	96	193	285	236	4.8	2.0	0.247 **
86	93	202	291	245	4.75	1.95	0.246 **
91	90	208	294	249	4.8	2.0	0.263 **
95	89	215	300	257	4.8	2.0	0.266 **
100	89	222	308	230	4.8	2.0	0.266 **
95	91	230	316	271	5.0	2.05	0.278 **
110	98	255	348	300	5.35	2.15	0.290 **
117	122	298	415	353	6.3	2.5	0.318 **
	127	307	430	366	6.3	2.5	0.307 **
124	127	311	433	370	6.25	2.5	0.304 **
127	127	318	440	376	6.2	2.5	0.301 **
129	126	318	440	376	6.2	2.4	0.292 **
131	124	321	440	380	6.2	2.45	0.302 **

$$* T_m = \frac{T_1 - T_2}{\ln \frac{T_1}{T_2}}$$

** Values averaged to give the apparent conductivity of stainless steel.

The conductivities K_2 of lithium, sodium and eutectic NaK were calculated as follows:

$$q = K_1 A_1 \frac{\Delta T}{X} + K_2 A_2 \frac{\Delta T}{X}$$

$$K_2 = \frac{\frac{qX}{\Delta T} - K_1 A_1}{A_2}$$

$$K_2 = \frac{\frac{EI}{4.185} \frac{(2)(2.54)}{\Delta T} - (0.276)(0.49)}{2.36}$$

$$K_2 = \frac{0.515EI}{\Delta T} - 0.057 \quad (2)$$

K_2 = thermal conductivity of lithium, sodium or eutectic NaK
[cal/(sec)(sq.cm)(°C per cm)]

A_2 = cross-sectional area of the liquid metal whose conductivity is being measured. (sq.cm)

The rather high value of 0.276 for the apparent conductivity of the stainless steel is due to the occurrence of heat losses. It was assumed that this value would not change markedly with each run, and it was used in the derivation of equation (2) for calculating the relative conductivities of lithium, sodium and eutectic NaK. Although several simplifying assumptions have been made in the calculations, it is believed that they introduce no greater error than that introduced by the experimental conditions. Tables III through VI contain the experimental data used in calculating the relative thermal conductivities.

Table III

THERMAL CONDUCTIVITY OF LITHIUM $K = \frac{0.515 EI}{\Delta T} - 0.057$

(Apparatus in open air at room temperature)

Run No. 1

ΔT	T_2	T_1	T_m^*	E Volts	I Amps	K cal/(sec)(sq.cm)(°C per cm)
215	210	420	310	13.0	5.2	0.105
234	220	449	329	13.0	5.2	0.072
238	226	460	336	13.0	5.2	0.089
242	232	470	344	13.0	5.2	0.087
246	236	477	350	13.0	5.2	0.084
250	240	484	358	13.0	5.2	0.089
251	244	489	361	13.0	5.2	0.001
254	246	495	365	13.0	5.2	0.080
254	248	497	366	13.0	5.2	0.080
256	250	500	370	13.0	5.2	0.079
258	251	503	373	13.0	5.2	0.076
260	252	504	377	13.0	5.2	0.077
260	253	506	376	13.0	5.2	0.077
260	254	506	378	13.0	5.2	0.077
260	255	508	379	13.0	5.2	0.077

Run No. 2

192	176	364	---	14.0	5.0	0.130
200	188	384	---	14.0	5.0	0.123
202	192	388	280	13.7	5.0	0.118
206	196	397	285	13.7	5.0	0.114
210	202	408	293	13.7	5.0	0.111
212	206	414	300	13.7	5.0	0.109
206	206	408	295	13.0	4.8	0.099
206	206	408	295	13.0	4.76	0.099
206	206	408	295	13.0	4.8	0.099
206	208	410	299	13.0	4.8	0.099
220	216	432	311	14.1	5.2	0.114
222	222	440	299	14.1	5.2	0.113
226	228	448	325	14.1	5.2	0.111
228	232	455	332	14.1	5.2	0.108
230	234	458	333	14.1	5.2	0.107

$$* T_m = \frac{T_1 - T_2}{\ln \frac{T_1}{T_2}}$$

Table IV

THERMAL CONDUCTIVITY OF LITHIUM $K = \frac{0.515 EI}{\Delta T} - 0.057$

(Apparatus in heated oven)

Run No. 1

Furnace Temp. °C	ΔT °C	T_2 °C	T_1 °C	T_m^*	E Volts	I Amps	K cal/(sec)(sq.cm)(°C per cm)
170	29	203	230	217	8.0	3.0	0.369
170	52	228	276	252	8.0	3.0	0.181
170	58	238	292	265	8.1	3.0	0.156
170	38	244	279	261	5.4	2.0	0.089
170	36	248	281	265	5.4	2.0	0.097
170	36	248	282	265	5.4	2.0	0.097
170	36	250	284	267	5.4	2.0	0.097
170	36	251	285	268	5.4	2.0	0.097
170	36	252	286	269	5.4	2.0	0.097
170	42	242	282	262	5.55	2.05	0.082
170	42	253	293	273	5.4	2.0	0.075
170	45	226	268	247	5.4	2.0	0.066
170	46	214	258	236	5.4	2.0	0.064

Run No. 2

155	44	212	253	233	5.4	2.0	0.069 **
155	39	210	246	228	5.4	2.0	0.085 **
155	40	210	248	229	5.3	2.0	0.079 **
155	41	210	248	229	5.3	2.0	0.076 **
155	41	210	248	229	5.35	2.0	0.077 **
155	41	210	248	229	5.3	2.0	0.076 **
155	33	204	236	220	4.75	1.8	0.076 **
155	33	204	236	220	4.7	1.8	0.075 **
155	32	202	234	218	4.75	1.8	0.080 **

$$* T_m = \frac{T_1 - T_2}{\ln \frac{T_1}{T_2}}$$

** Values averaged to give the relative thermal conductivity of liquid lithium.

Table V

$$\text{THERMAL CONDUCTIVITY OF SODIUM } K = \frac{0.515 EI}{\Delta T} - 0.057$$

(Apparatus in open air at room temperature)

Run No. 1

Furnace Temp. °C	ΔT °C	T_2 °C	T_1 °C	T_m^* °C	E Volts	I Amps	K cal/(sec)(sq.cm)(°C per cm)
---	45	72	---	---	11.5	4.4	---
---	63.5	86	---	---	10.6	4.0	---
---	80	98	178	134	10.8	4.0	0.221
---	110.4	112	212	157	10.7	4.0	0.142
---	116	120	236	172	10.2	4.0	0.124
---	116	125	241	177	10.0	4.0	0.120
---	116	128	244	180	10.2	4.0	0.124
---	117	131	248	183	10.2	4.0	0.122
---	116	131	247	183	10.1	3.9	0.118
---	114	132	246	184	10.0	3.9	0.119
---	114	132	246	184	10.2	4.0	0.127
---	118	133	251	186	10.5	4.05	0.128
---	116	135	251.5	187	10.2	4.0	0.124
---	116	135	251.5	187	10.2	4.0	0.124
---	118	136	254	189	10.2	4.0	0.121
---	116	136	253	187	10.2	4.0	0.124

(Apparatus in heated oven)

Run No. 2

100	21	119	140	130	5.3	2.2	0.229
---	20	124	144	136	4.9	2.0	0.195
---	21	135	156	145	5.0	2.0	0.128
120	23.2	164	187	177	5.2	2.1	0.125
---	23	175	198	188	4.9	2.0	0.162 **
---	23	179	202	188	4.9	2.0	0.162 **
130	22	184	206	199	4.85	1.95	0.164 **
---	22	187	209	199	4.8	1.95	0.162 **
---	22	190	212	199	4.8	1.95	0.162 **
132	22	191	213	208	4.8	1.95	0.162 **
140	56.6	233	289.6	248	7.5	3.0	0.145
143	55.2	238	288	268	7.5	3.0	0.153
145	55.2	243	293	268	7.5	3.0	0.153
149	56	249	305	276	7.5	3.0	0.150
150	56	252	308	276	7.5	3.0	0.150
150	56	273	329	276	7.5	3.0	0.150

$$* T_m = \frac{T_1 - T_2}{\ln \frac{T_1}{T_2}}$$

** Values averaged to give the relative thermal conductivity of liquid sodium.

Table VI

THERMAL CONDUCTIVITY OF EUTECTIC NaK $K = \frac{0.515 EI}{\Delta T} - 0.057$

(Apparatus in heated oven)

Run No. 1

Furnace Temp °C	ΔT °C	T_2 °C	T_1 °C	T_m^* °C	E Volts	I Amps	K cal/(sec)(sq.cm)(°C per cm)
23	51	50	100	73.5	5.0	2.0	0.044
23	54	58	110	82	4.9	2.0	0.036
24	58	61	117	87	4.95	2.0	0.031
25	58	64	120	90	4.95	2.0	0.031
25	59	67	124	93.3	4.90	2.0	0.028
33	59	70	128	96.7	4.85	2.0	0.027
60	56	82	135	108	4.9	2.0	0.033
69	56	98	151	124	5.0	2.0	0.035
75	56	110	164	136.6	5.0	2.0	0.035
78	59	116	172	144	5.0	2.0	0.030
90	54	135	186	162	5.0	2.0	0.039 **
104	120	195	311	251	7.6	3.0	0.041 **
123	113	231	340	286	7.7	3.0	0.048 **
126	115	233	344	287	7.7	3.0	0.046 **
130	153	260	409	332	9.8	3.8	0.068
132	157	266	418	338	9.8	3.8	0.065
133	160	271	426	345	9.8	3.8	0.063
133	162	273	430	348	9.8	3.8	0.061

Run No. 2

33	54	80	120	100	4.95	2.0	0.037
42	55	82	134	112	4.9	2.0	0.034
58	53	89	140	119	4.8	1.95	0.033
66	54	102	153	133	5.1	2.1	0.045
74	53	110	161	140	4.9	2.0	0.038
78	52	119	168	150	4.9	2.0	0.040
83	51	126	174	158	4.9	2.0	0.042
90	51	135	183	168	5.0	2.0	0.043
93	50	142	140	141	4.95	2.0	0.045
117	98	219	330	239	7.1	2.8	0.047
122	98	219	330	239	7.1	2.8	0.047
129	156	260	412	339	9.9	3.8	0.067
130	159	266	420	349	9.9	3.8	0.064

$$* T_m = \frac{T_1 - T_2}{\ln \frac{T_1}{T_2}}$$

** Values averaged to give the relative thermal conductivity of eutectic NaK.

Results and Remarks

	Li	Na	NaK
Mean liquid temperature, T_m ($^{\circ}\text{C}$)	218-233 $^{\circ}$	190-200	250-285
Temperature difference, ΔT ($^{\circ}\text{C}$)	32-44	22-23	120-114
Relative thermal conductivity, K [cal/(sec)(sq.cm)($^{\circ}\text{C}$ per cm)]	0.077	0.162	0.043

It is probable that the 0.5% of impurities contained in the molten lithium tended to decrease its thermal conductivity, and that somewhat higher values might have been obtained for lithium of a higher purity.

SPECIFIC HEAT OF LIQUID LITHIUM

Apparatus and General Technique

The specific heat of liquid lithium was determined by comparing the cooling rates in air of lithium-filled and aluminum-filled thin-wall stainless steel capsules of the type shown in Figure 5. These capsules were identical with respect to size and shape, but varied slightly in weight. One capsule was filled with 42 grams of lithium using the charging technique shown in Figure 2. Lithium of the same purity as that used in the thermal conductivity measurement was used here; its analysis is given in Table I. Two aluminum slugs weighing 224 grams and 109 grams were machined to fit into similar stainless steel capsules and sealed therein. These particular slugs of aluminum were selected because the cooling rates of their respective capsules were slower and faster than the cooling rate of the lithium-filled capsule. The three capsules and their contents were simultaneously heated to 600°C in a vertical electric furnace, then simultaneously removed and arranged on a magnesia block to cool in air under a glass bell-jar. The capsules were located at the vertices of an equilateral triangle with approximately 2 inches distance between them. A thermocouple from each capsule was connected to a multiple potentiometric recorder which traced the cooling curves shown in Figure 6.

Calculations

The specific heat of lithium was calculated by using a known value for the specific heat of aluminum and interpolating between the reciprocal slopes of the cooling curves, which is the time required to cool one degree centigrade at any temperature. Such an interpolation is valid since the reciprocal of the cooling rate (sec per degree) is directly proportional to the specific heat. The reciprocal slopes are tabulated in Table VII for several temperatures.

**FIGURE 5 THIN WALL STAINLESS STEEL CAPSULE FOR
SPECIFIC HEAT MEASUREMENTS.**

Table VII

Wt. of Capsule (gms.)	Wt. of Capsule Content (gms.)	Reciprocal Slope at Temperature (sec. per deg. Cent.)			
		200°C	300°C	400°C	500°C
225	224 Al	0.293	0.153	0.085	0.055
230	42 Li	0.251	0.135	0.078	0.046
222	109 Al	0.231	0.108	0.062	0.028

In the following calculations each stainless steel capsule was assumed to weigh 222 grams, and the difference between this value and the actual weight was expressed as equivalent weight of aluminum. The specific heat of stainless steel (18-8) was obtained by using the value 0.118° at 100°C, and assuming that the temperature coefficient of the specific heat of stainless steel is the same as that for alpha iron in the range 100°C to 500°C. The variation of the specific heat of stainless steel with temperature is given in Figure 7.

x = reciprocal slope of 224 grams Al

y = reciprocal slope of 42 grams Li

z = reciprocal slope of 109 grams Al

$C_p(\text{Al})$ = specific heat of aluminum (cal/gm/°C)

$C_p(\text{Li})$ = specific heat of lithium (cal/gm/°C)

$C_p(\text{ss})$ = specific heat of stainless steel (cal/gm/°C)

W_1 = 224 grams Al

W_2 = 42 grams Li

W_3 = 109 grams Al

Δ_{ss1} = difference in weight of capsule containing 224 gms Al and that containing 109 gms Al

Δ_{ss2} = difference in weight of capsule containing 42 gms Li and that containing 109 gms Al

$$W_2 C_p(\text{Li}) + \Delta_{ss2} C_p(\text{ss}) = W_1 C_p(\text{Al}) + \Delta_{ss1} C_p(\text{ss}) - \left(\frac{x-y}{x-z} \right) (W_1 C_p(\text{Al}) + \Delta_{ss1} C_p(\text{ss}) - W_3 C_p(\text{Al}))$$

$$C_{p(\text{Li})} = \frac{W_1 + (\Delta ss_1 - \Delta ss_2) \frac{C_{p(ss)}}{C_{p(\text{Al})}} - \left(\frac{x-y}{x-z} \right) \left(W_1 + \Delta ss_1 \frac{C_{p(ss)}}{C_{p(\text{Al})}} - W_3 \right)}{W_2} \cdot C_{p(\text{Al})}$$

at any temperature

$$C_{p(\text{Li})} = \frac{224 + (3-8) \frac{C_{p(ss)}}{C_{p(\text{Al})}} - \left(\frac{x-y}{x-z} \right) \left(224 + 3 \frac{C_{p(ss)}}{C_{p(\text{Al})}} - 109 \right)}{42} \cdot C_{p(\text{Al})}$$

Results

The calculated values for the specific heats of liquid lithium as well as the assumed specific heats of aluminum used in these calculations are given in Table VIII. Values for the specific heats of sodium and eutectic NaK are also given to facilitate a comparison of the three liquid metals. These data appear in Figure 8 in plotted form.

Table VIII

A COMPARISON OF THE SPECIFIC HEATS OF LIQUID LITHIUM,
SODIUM AND EUTECTIC NaK

Temp. °C	Assumed $C_{p(\text{Al})}$ (1) cal/gm/°C	Calc. $C_{p(\text{Li})}$ cal/gm/°C	$C_{p(\text{Na})}$ (4) cal/gm/°C	$C_{p(\text{NaK})}$ (5) cal/gm/°C
100	---	---	0.331	0.231
200	0.237	0.804	0.320	0.226
300	0.245	1.03	0.312	0.224
350	---	---	---	0.223
400	0.253	1.11	0.306	---
500	0.261	1.14	0.302	---

FIGURE 8 SPECIFIC HEAT VS. TEMPERATURE

The capsules and their contents were re-heated a second time after they had cooled to room temperature, and the calculated results of the two tests were found to agree to within $\pm 3\%$. The accuracy of the calculated specific heats of molten lithium is probably of the order of $\pm 10\%$.

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