

# Lawrence Berkeley National Laboratory

## Recent Work

### Title

LOW-TEMPERATURE SPECIFIC HEAT OF APIEZON-N GREASE

### Permalink

<https://escholarship.org/uc/item/1zp7j20k>

### Authors

Wun, Marilyn  
Phillips, Norman E.

### Publication Date

1974-10-01

0 0 0 0 4 2 0 1 9 0 8

Submitted to Cryogenics

LBL-3185  
Preprint c. |

LOW-TEMPERATURE SPECIFIC HEAT OF  
APIEZON-N GREASE

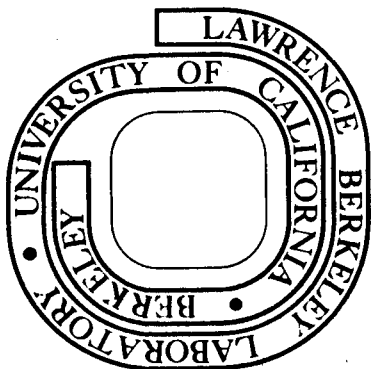
Marilyn Wun and Norman E. Phillips

October 1974

Prepared for the U. S. Atomic Energy Commission  
under Contract W-7405-ENG-48

**For Reference**

Not to be taken from this room



LBL-3185  
c. |

## **DISCLAIMER**

This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by its trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or the Regents of the University of California.

LOW-TEMPERATURE SPECIFIC HEAT OF APIEZON-N GREASE

Marilyn Wun and Norman E. Phillips

Inorganic Materials Research Division, Lawrence Berkeley Laboratory and  
Department of Chemistry; University of California  
Berkeley, California 94720, U.S.A.

ABSTRACT

Data are presented for the specific heat of Apiezon-N Grease between  
0.4 and 20 K.

Apiezon-N grease<sup>1</sup> has been used in this laboratory and in several others to establish thermal contact to samples used in heat capacity measurements. It has proven satisfactory for attaching both solid samples and powders to calorimeters. We have measured the specific heat of this grease between 0.4 and 20 K to provide the data necessary for correcting the measured heat capacity for that of the grease.

We expect an overall accuracy of approximately 1% in the total measured heat capacity but the accuracy of the values reported for the grease is further limited, particularly at low temperatures, by the heat capacity of the calorimeter. The specific heat of the grease was 5% of the total heat capacity at 0.4 K, 10% at 1 K, and 50% or more at 4 K and above. The results are shown in Figs. 1 and 2 which emphasize the data above 1.5 K and below 1.5 K, respectively. There is a minimum in  $C/T^3$  near 0.8 K but the accuracy of the measurements at lower temperatures does not permit a precise characterization of the deviations from a  $T^3$  temperature dependence. The results are presented as a smoothed table of values of  $C/T^3$  in Table I and as a power-series expansion that fits the data between 1 and 20 K to  $\pm 1\%$  in Table II.

A specific heat of  $0.0325T^3$  mJ/g-K has been reported<sup>2</sup> near 1 K, and other measurements<sup>3</sup> extend from 80K to 325 K. Between 1 and 20 K our data for the specific heat of Apiezon-N grease are approximately 10% lower in magnitude than, but similar in temperature dependence to those<sup>4</sup> for Apiezon-T grease. The temperature dependences<sup>3,4</sup> of the specific heats of the two greases are also very similar between 80 and 220 K.

-----  
Work done under the auspices of the U. S. Atomic Energy Commission.

## REFERENCES

1. Supplied by Apiezon Products Ltd., 8 York Road, London, England, and sold in the U.S.A. by James G. Biddle Co., Plymouth Meeting, PA 19462.
2. Scheffer, J., private communication quoted by Wielinga, R. F., Thesis, Leiden University, 1968.
3. Bunting, J. G., Ashworth, T., and Steeple, H., Cryogenics 9, (1969) 385.
4. Westrum, E. F., Jr., Chow, Chien, Osborne, D. W., and Flotow, H. E., Cryogenics 7, (1967) 43.

Table I. The specific heat of Apiezon-N grease.

<u>T(K)</u>	<u>C/T<sup>3</sup> (mJ/g-K<sup>4</sup>)</u>	<u>T(K)</u>	<u>C/T<sup>3</sup> (mJ/g-K<sup>4</sup>)</u>
0.4	0.0812	8.0	0.02805
0.7	0.0306	9.0	0.02620
1.0	0.02630	10.0	0.02431
1.5	0.02661	11.0	0.02244
2.0	0.02741	12.0	0.02071
2.5	0.02870	13.0	0.01917
3.0	0.03010	14.0	0.01780
3.5	0.03112	15.0	0.01652
4.0	0.03182	16.0	0.01538
4.5	0.03200	17.0	0.01436
5.0	0.03198	18.0	0.01340
6.0	0.03142	19.0	0.01250
7.0	0.02990	20.0	0.01169

Table II. Power series representation of the heat capacity of Apiezon-N grease,  $C = \sum A_n T^n$  with C in mJ/g-K and T in K, valid to  $\pm 1\%$  between 1 and 20 K.

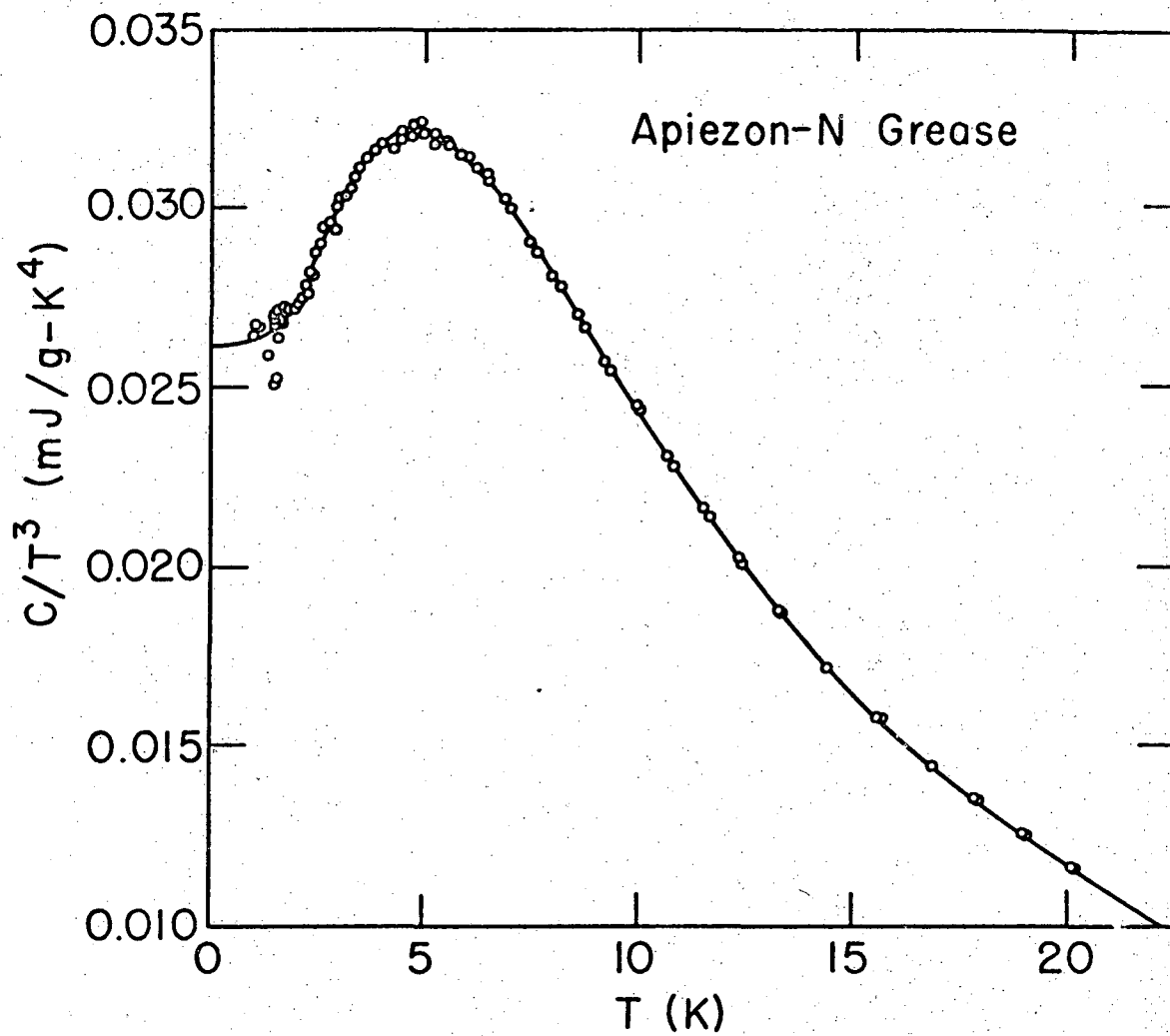
<u>n</u>	<u>A<sub>n</sub></u>
3	$2.80019 \times 10^{-2}$
4	$-4.87887 \times 10^{-3}$
5	$3.81416 \times 10^{-3}$
6	$-9.072917 \times 10^{-4}$
7	$9.76703 \times 10^{-5}$
8	$-5.23844 \times 10^{-6}$
9	$1.21072 \times 10^{-7}$
11	$-3.12038 \times 10^{-11}$



FIGURE CAPTIONS

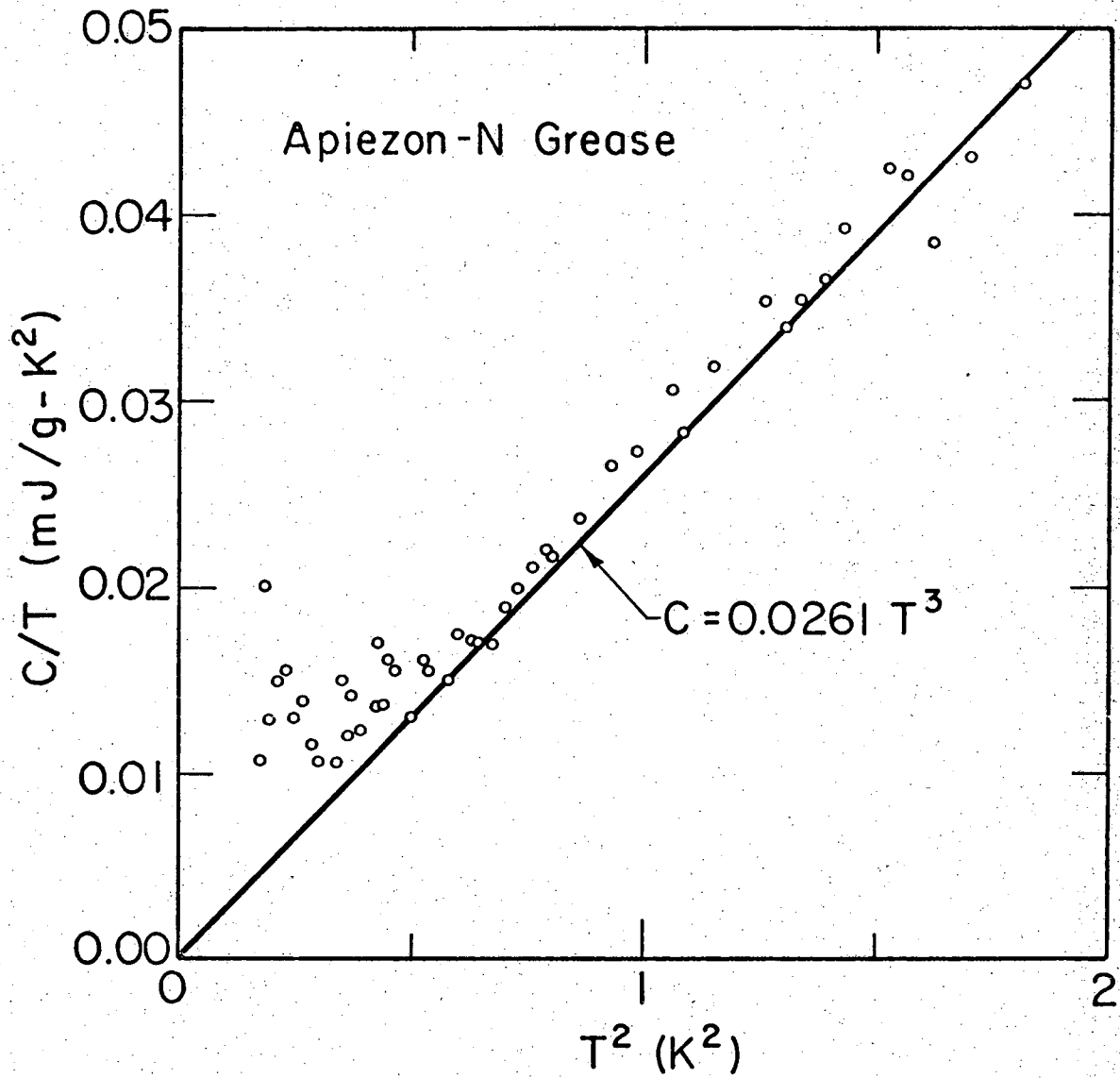
Fig. 1. The specific heat of Apiezon-N grease above 1 K.

Fig. 2. The specific heat of Apiezon-N grease below 1.4 K.



XBL 749-7267

Fig. 1



XBL 749-7273

Fig. 2

## LEGAL NOTICE

*This report was prepared as an account of work sponsored by the United States Government. Neither the United States nor the United States Atomic Energy Commission, nor any of their employees, nor any of their contractors, subcontractors, or their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights.*

TECHNICAL INFORMATION DIVISION  
LAWRENCE BERKELEY LABORATORY  
UNIVERSITY OF CALIFORNIA  
BERKELEY, CALIFORNIA 94720