paraelectric (300 K) and ferroelectric (100 K) phases. The broadening of the 752; 840; 660;... lines (for convenience the indices on the x-ray picture of the ferroelectric phase in Fig.2b are referred to the original paraelectric phase) are clearly seen in Fig.2b, connected with formation of a domain structure.

In conclusion the authors express their thanks to I. P. Luneva for help in preparing working drawings of the cryostat.

Reference

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Low temperature specific heat of Apiezon N grease

M. Wun and N. E. Phillips

Apiezon N grease [1] 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 dependance. The results are presented as a smoothed table of values of C/T^3 in Table 1 and as a power-series expansion that fits the data between 1 and 20 K to ±1% in Table 2.

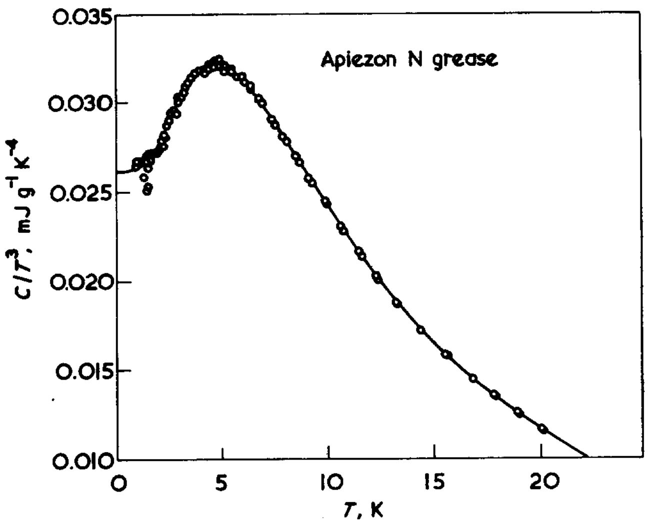

Fig.1 The specific heat of Apiezon N grease above 1 K

Table 1. The specific heat of Apiezon N grease

T, K	C/T^3, mJ g^{-1} K^{-4}	T, K	C/T^3, mJ g^{-1} K^{-4}
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 2. Power series representation of the heat capacity of Apiezon N grease

$C = \Sigma A_n T^n$ with C in mJ g^{-1} K^{-1} and T in K, valid to ±1% between 1 and 20 K

n	A_n
3	2.80019×10^{-2}
4	-4.87887×10^{-3}
5	3.81486×10^{-3}
6	-9.072917×10^{-4}
7	9.76703×10^{-5}
8	-5.23844×10^{-6}
9	1.21072×10^{-7}
11	-3.12038×10^{-11}

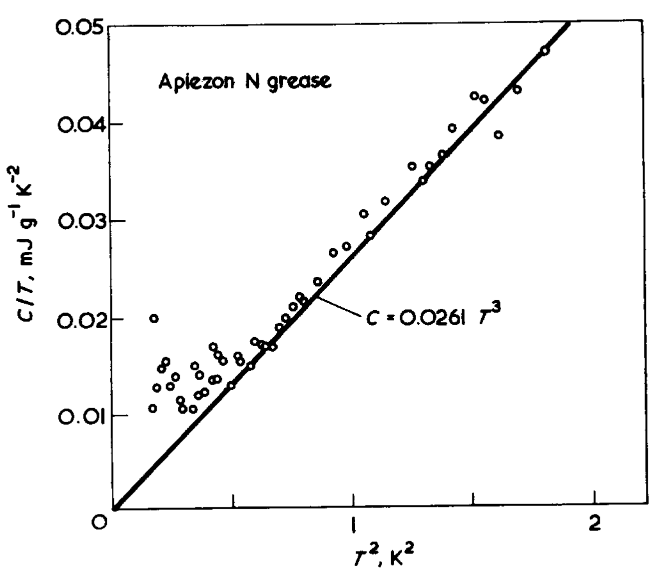

Fig.2 The specific heat of Apiezon N grease below 1.4 K

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A specific heat of $0.0325T^3$ mJ g^{-1} K^{-1} has been reported [2] near 1 K, and other measurements [3] extend from 80 K 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 [4] for Apiezon T grease. The temperature dependences [3,4] of the specific heats of the two greases are also very similar between 80 and 220 K.

References

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A cryostat and discharge tube for investigating electron emission from superconducting surfaces in ultra high vacuum

M. H. Cobourne and W. T. Williams

In order to study the rate of electron emission from the surface of metallic electrodes immersed in a vacuum ($\sim 10^{-8}$ torr) it is necessary to apply an electric field $\gtrsim 10^7$ V m^{-1} between the electrodes. At these values of the field, currents of the order 10^{-4} A can flow between the electrodes, producing considerable heating. When investigating emission from electrodes in the superconducting state rapid conduction of this heat away from the electrodes must be ensured in order to maintain their temperature below the transition temperature.

The discharge tube and cryostat used in the investigation were designed for this purpose and to comply with the following conditions:

(a) easily demountable electrodes,

(b) variable electrode gap separation (< 1 mm) with a means of setting the gap accurately parallel at room temperature. Measurement of the separation at 4.2 K must also be effected in case its value changes due to contraction,

(c) continuous measurement of the temperature of the cathode,

(d) evacuation of the discharge tube to $\sim 10^{-8}$ torr at room temperature.

The design of the discharge tube and cryostat is shown in Fig.1. The overall dimensions of the discharge tube was length 30 cm and diameter 7 cm. It consisted of a pyrex glass vessel, P, joined at each end to steel flanges, B. Each electrode was 11 mm diameter and 6 mm thick. The anode, A, was screwed into a rod of HC copper of the same diameter, the copper rod passing through the flange into the region of the cryostat which contained liquid helium. The cathode, C, was also screwed into a copper base of a few mm thickness, the copper being joined to a hollow pyrex glass tube, D, which in turn was sealed to the flange, E. When the cryostat was filled, the liquid helium was separated from the cathode only by the thin copper base. Rapid conduction of heat away from both electrodes was therefore ensured.

The electrode separation was adjusted and set parallel by three screws, F, placed symmetrically. These extended or contracted the bellows, G. The temperature of the cathode was determined by means of a carbon resistor, H, placed in a small hole drilled through the cathode, and in thermal contact with it. The resistor was connected to an external temperature gauge via electrical bushings, J, in the flange, and in the lid of the cryostat. Electrical connexion to the cathode was made in a similar manner. Connexion to the anode was made via a 50 kV bushing, K, in the cryostat lid and a coaxial cable (without its earth shield) to the copper projection in flange B. The discharge tube was evacuated through the pipe, L, and through M which also served to suspend the discharge tube inside the cryostat.

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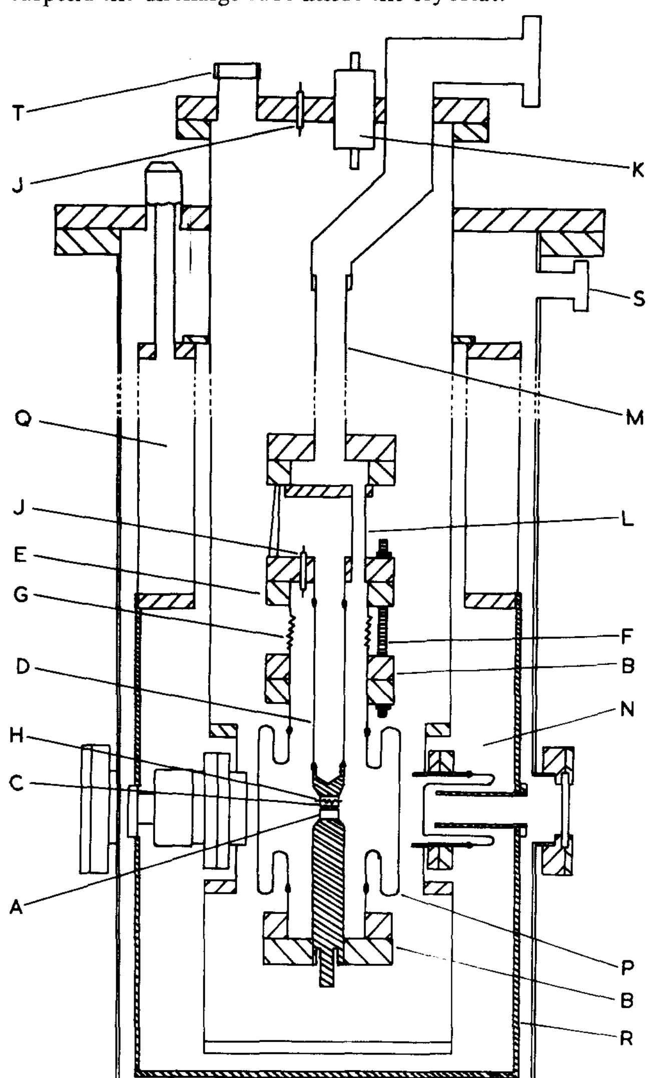

Fig.1 Design of discharge tube and cryostat for low temperature electron emission studies