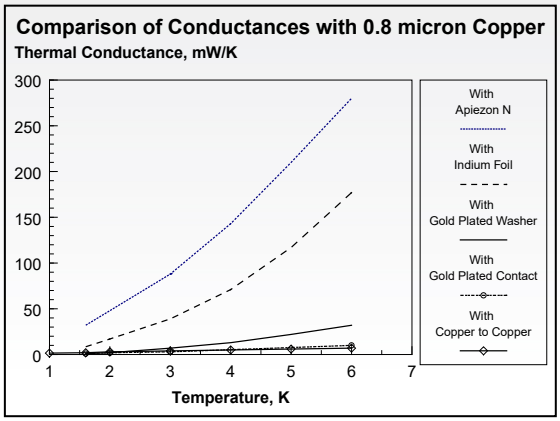
Thermal Conductance at Liquid Helium Temperatures

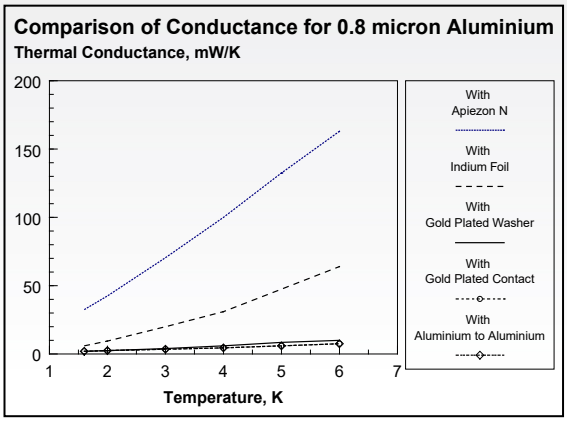
Work carried out at the NASA - Ames Research Centre at Moffett Field, California, USA in association with Trans Bay Electronics has shown that pressed metallic contacts augmented with Indium Foil or Apiezon N grease show an improvement in terms of thermal conductance ranging from a factor of three for Stainless Steel to one order of magnitude for Copper contacts, over a temperature range of 1.6 - 6.0°K[1].

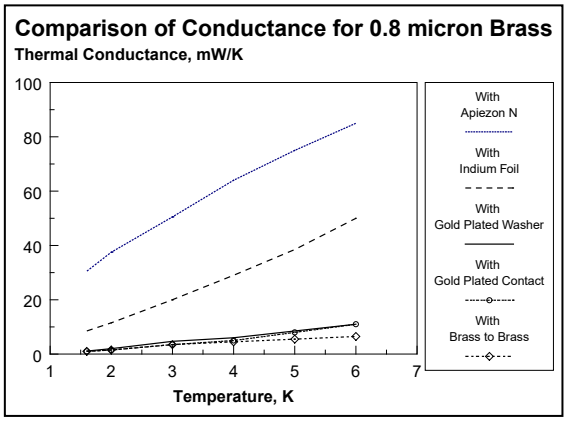
Further examination of the data produced by this work shows that there are significant advantages in terms of thermal conductance with the use of Apiezon N grease in these contacts over the use of Indium foil or Gold plating.

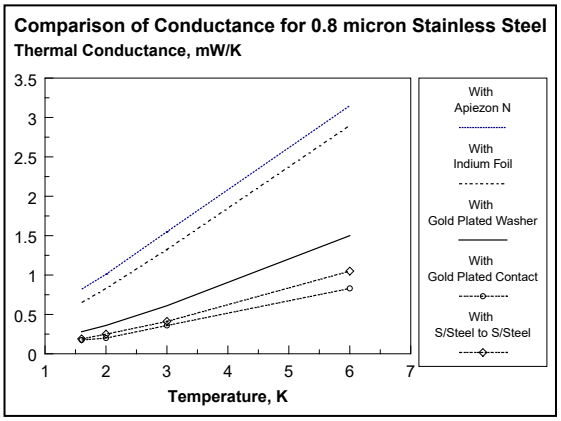
The four graphs below compare the conductance obtained from contacts of Copper, Aluminium, Brass and Stainless Steel, all with 0.8 μm finished surfaces and at an applied force of 670 Newtons. The contacts were made using uncoated metal, Gold plated metal, and with the contacts augmented individually with a Gold plated Aluminium washer, Indium Foil and Apiezon N grease.

It can be seen that the use of Apiezon N grease provides greatly improved conductance over the uncoated contacts. Further a significant improvement in thermal conductance over Gold plating and Indium was realised with Apiezon N grease in the case of the Aluminium, Brass and Copper contacts.









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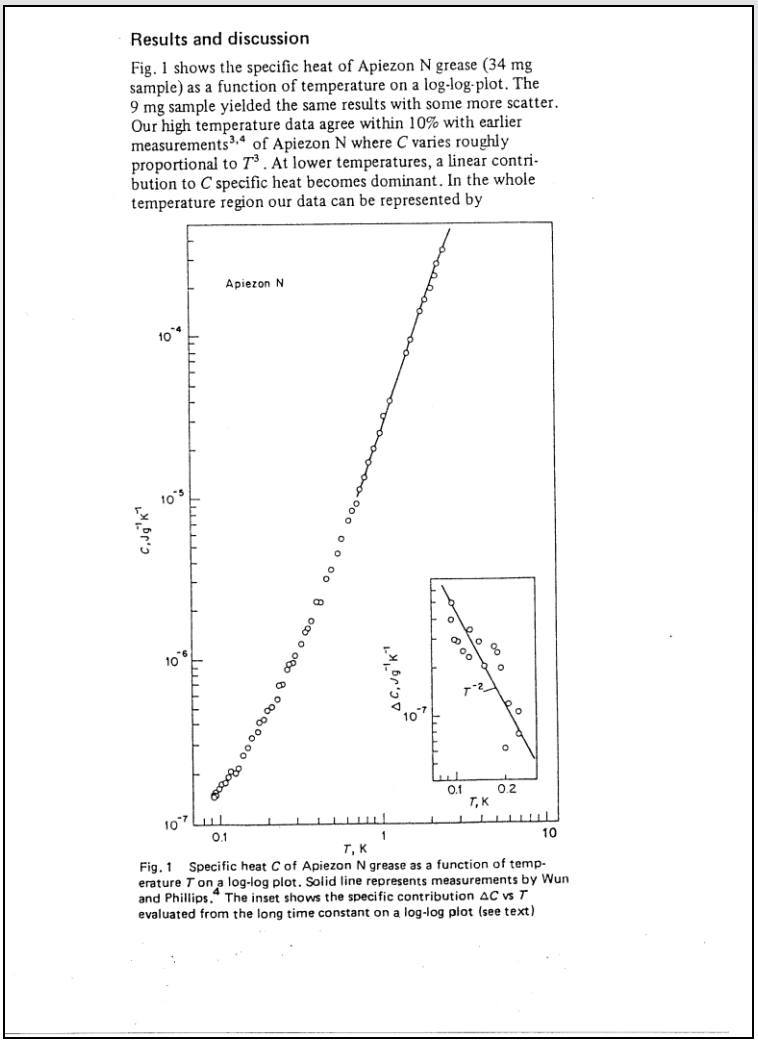
Specific Heat at Very Low Temperatures

Apiezon N grease is widely used to provide thermal contact in low temperature research.

The Specific Heat of Apiezon N grease is shown on a log-log plot below as a function of temperature, T, as determined by Wun and Phillips[2] and extended by Schink and Lohneysen[3].



Results and discussion

Fig. 1 shows the specific heat of Apiezon N grease (34 mg sample) as a function of temperature on a log-log-plot. The 9 mg sample yielded the same results with some more scatter. Our high temperature data agree within 10% with earlier measurements[3,4] of Apiezon N where C varies roughly proportional to T^3. At lower temperatures, a linear contribution to C specific heat becomes dominant. In the whole temperature region our data can be represented by

Fig. 1 Specific heat C of Apiezon N grease as a function of temperature T on a log-log plot. Solid line represents measurements by Wun and Phillips.[4] The inset shows the specific contribution ΔC vs T evaluated from the long time constant on a log-log plot (see text)

1 Thermal conductance of metallic contacts augmented with Indium foil or Apiezon N grease at liquid Helium temperatures, J.Salerno, P.Kittel, A.L.Spivak - Cryogenics 1994, Volume 34, Number 8.

2 M. Wun and N.E. Phillips, Cryogenics 15 (1975) 36

3 Specific Heat of Apiezon N grease at very low temperatures, Schink H.J. and Lohneysen H.V. Cryogenics 1981

Copies of these papers are available on request.

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