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ABSTRACT

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Melting of Rubidium at High Pressures

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The melting curve of rubidium at pressures to 60 kbar has been investigated by a differential thermal conductivity technique in a tetrahedral anvil device. The results indicate that the rubidium melting curve rises smoothly to about 260°C at 60 kbar with no maximum being observed. The present data agree well with the results of Newton, et al.,[1] and it appears quite certain that if a maximum in the melting curve of rubidium exists, it occurs at a pressure higher than 60 kbar.

[1] R. C. Newton, A. Jayaraman, and G. C. Kennedy, J. Geophys. Res. 67, 2559 (1962).

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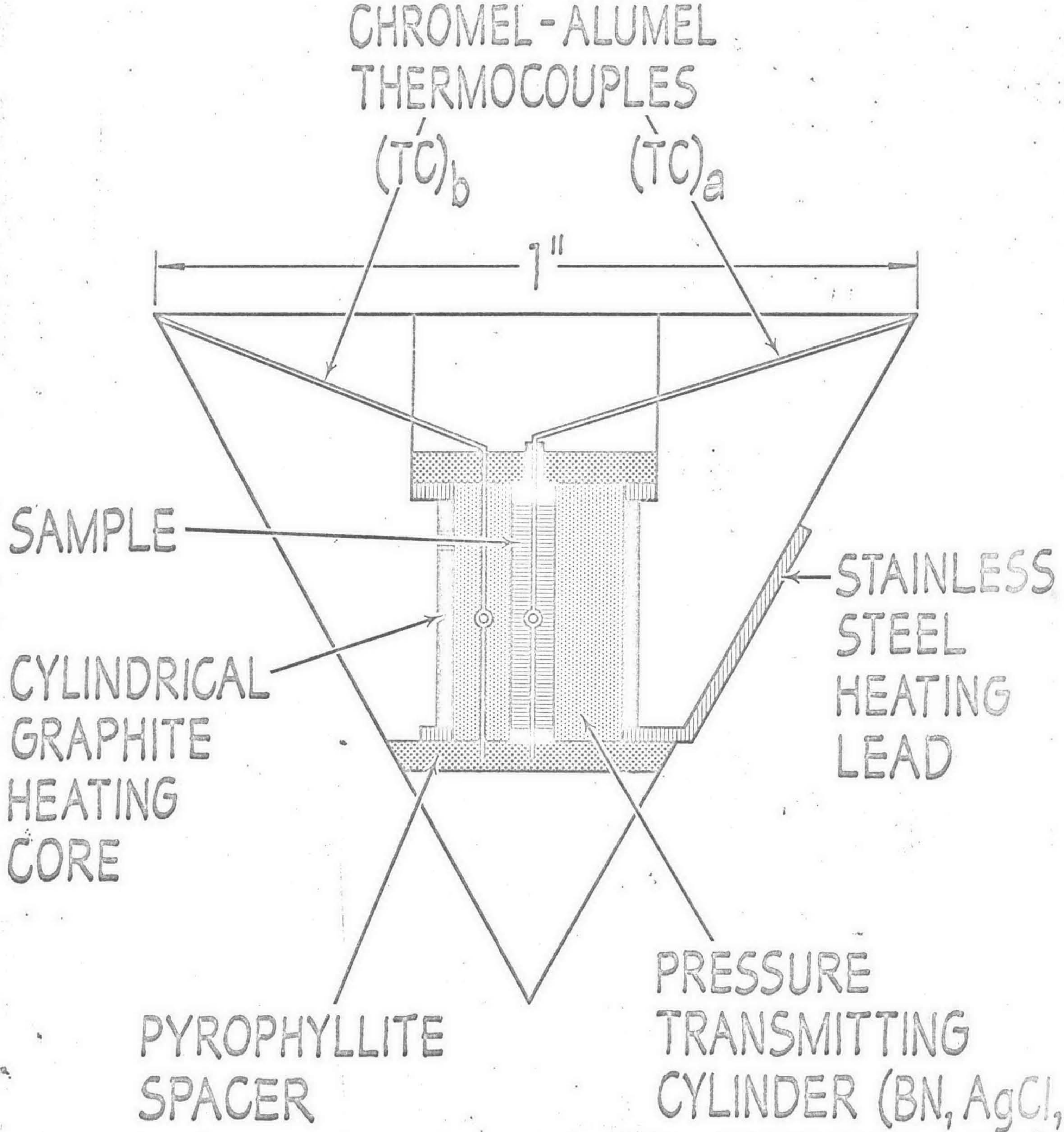
As part of a continuing program of investigation of melting phenomena at elevated pressures, the melting point curve of Rb has been re-examined to about 60 kbar. Conflicting evidence as to the shape of the Rb melting curve exists in the literature, Bundy[1] having found a maximum at about 45 kbar using resistance measurements, while Newton, Jayaraman, and Kennedy[2] found a continuously rising curve to 50 kbar with differential thermal analysis. It was felt, therefore, that it would be of some interest to attempt to definitely establish if there is a maximum in the Rb melting curve.

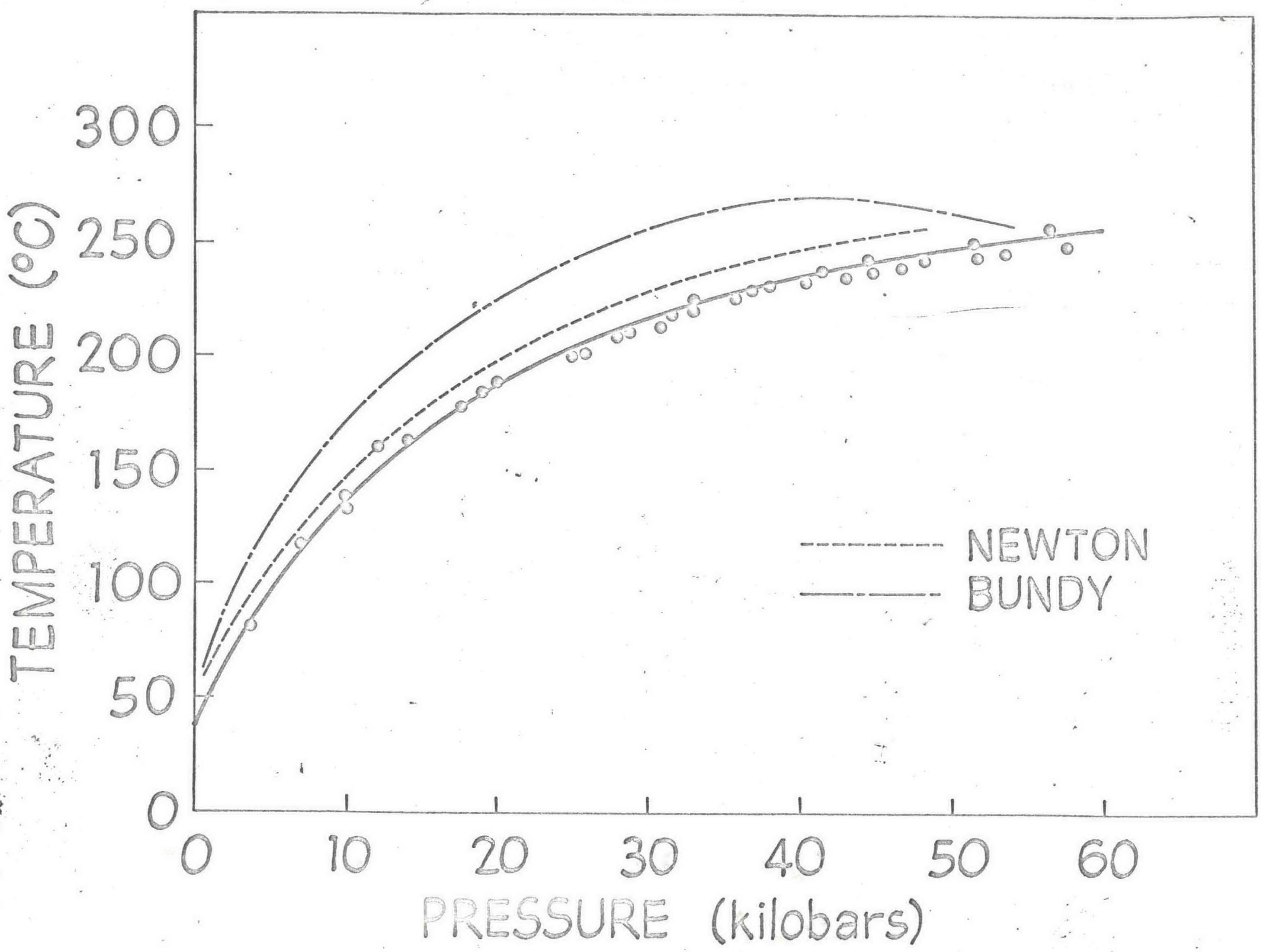
The experiments were performed in a tetrahedral anvil high pressure apparatus, using a differential thermal conductivity technique.[3] The sample cell used is shown in Figure 1. A graphite resistance heater was utilized in obtaining high temperatures, and either BN or pyrophyllite was used to encapsulate the sample. Two chromel-alumel thermocouples were placed as shown in Figure 1, and the measurements consisted of automatically recording the difference in temperature $\Delta T \equiv T_b - T_a$ as a function of the sample temperature T_a at constant pressure. If the thermal conductivity of the liquid differs from that of the solid, a discontinuous shift in the temperature dependence of ΔT is observed at the melting point. Repetition of isobaric runs at a number of pressures allows a determination of the effect of pressure on the melting point of the sample. The Rb samples were surrounded by mineral oil during loading in order to prevent oxidation. The Rb stock was obtained from the Fairmount Chemical Company and was stated to be double distilled.

The experimental data points obtained in the present study are shown in Figure 2, along with the data of Bundy[1] and Newton, et al.[2] The data are seen to agree quite well with those of Newton, et al[2], and no maximum is observed. The fact that our melting points lie a few percent below those of Newton, et al[2] could be explained on the basis of impurities introduced into our samples by the presence of the mineral oil surrounding the Rb. The close agreement of our results with Newton, et al[2] seems to indicate quite definitely that if a maximum exists in the melting curve of Rb, it occurs at a pressure higher than 60 kbar.

REFERENCES

1. F. P. Bundy, Phys. Rev. 115, 274 (1959).
2. R. C. Newton, A. Jayaraman, and G. C. Kennedy, J. Geophys. Res. 67, 2559 (1962).
3. F. A. Blum, Jr. and B. C. Deaton, Phys. Rev. Letters, 12, 697 (1964).


CHROMEL - ALUMEL
THERMOCOUPLES
(TC)b
(TC)a
1"
SAMPLE
STAINLESS
STEEL
HEATING
LEAD
CYLINDRICAL
GRAPHITE
HEATING
CORE
PRESSURE
TRANSMITTING
CYLINDER (BN, AgCl,
or PYROPHYLLITE)
PYROPHYLLITE
SPACER



TEMPERATURE (°C)
300
250
200
150
100
50
0
NEWTON
BUNDY
0
10
20
30
40
50
60
PRESSURE (kilobars)