Melting curve of rhenium up to 80 kbar

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We measured the melting curve of rhenium by an optical method up to 80 kbar. The curve rises somewhat with increasing pressure, from 3450°K at atmospheric pressure to 3770°K at 80 kbar.

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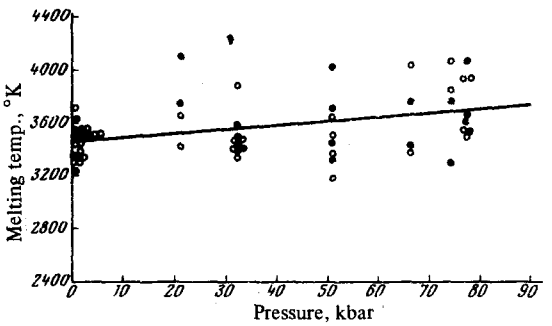
We present the results of measurements of the melting point of rhenium by an optical method.

The apparatus and the procedure were described by us in sufficient detail in earlier papers devoted to the melting curves of refractory metals.[1–4] We recall only that the sample was heated by passing alternating currents through it, and the melting temperature was determined from the ratio $I_1(\lambda_1)/I_2(\lambda_2)=f(T)$ of the intensities of two narrow spectral sections of the continuous emission spectrum of the investigated substance in accordance with Planck's radiation law. For greater reliability, each temperature was determined simultaneously from two intensity ratios of narrow spectral sections of one and the same radiation, $I_1(\lambda_1)/I_2(\lambda_2)=f_1(T)$ and $I_2(\lambda_2)/I_3(\lambda_3)=f_2(T)$, where $\lambda_1=420$ μ, $\lambda_2=622$ μ, and $\lambda_3=825$ μ. The temperatures corresponding to these ratios are marked on the figure by dark and light circles. The pressure in the apparatus was produced with the aid of a hydraulic press and was measured with a pointer-type manometer. The pressure calibration of the apparatus was based on the polymorphic transitions in bismuth, thallium, and barium, in accordance with the pressure scale established in 1968.

We investigated the melting curve of a metal having one of the highest melting temperatures, rhenium. We used in the experiment rhenium of 99.99% purity. The initial point of the melting curve was taken to be the melting temperature of rhenium at atmospheric pressure, namely 3450 °K.[5]

The results of the measurements, reduced by least squares, are shown in the figure, from which it is seen that the melting temperature of rhenium increases slightly with pressure, reaching 3700 °K at 80 kbar.



Melting curve of rhenium: ○—temperatures determined from $I_2(\lambda_2)/I_3(\lambda_3)$; ●—from $I_1(\lambda_1)/I_2(\lambda_2)$.

The rms error in the measurements of the temperatures and pressures did not exceed 6%.

M. N. Vostrikova took part in the work.

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