SPECIFIC HEAT OF TITANIUM CLOSE TO THE PHASE TRANSITION POINT

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The existing data on the specific heat of titanium close to the phase transition point [1–3] show poor agreement. There is an especially noticeable discrepancy between the results of direct measurements make by Backhurst [2] and Holland [3]. The work of the latter is also remarkable for the considerably measuring error, which close to the phase transition point reaches 10–15%. Accordingly, the present authors have measured the specific heat of titanium between 1000 and 1300° K. The measurements were made by the modulation method [4], with the difference that the amplitude of the temperature oscillations of the specimen was determined from the oscillations of its luminosity. In this case it is not convenient to use the temperature dependence of the electrical resistance, since close to the phase transitition point the resistance of titanium shows an anomalous variation. Temperature changes were previously determined on the basis of changes in luminosity in [5, 6]. The phase transition temperature of titanium is 1155° K; therefore, it was necessary to use a radiation receiver sensitive to infrared rays.

The measurements were made in vacuum on specimens of titanium iodide in the form of wires 0.5 mm diameter and 60–120 mm in length. To eliminate the effect of the ends, tungsten potential leads 0.03 mm in diameter were connected to the middle section of the specimens (length 30–50 mm). The specimens were heated with 50 cps alternating current. The amplitude of the temperature oscillations of the specimens was about 0.1° C. The emission from the middle part of the specimens impinged on a lead sulfide photoresistor. The photoresistor was connected in series with a dc voltage source and load resistance. The variable voltage across the load resistance, due to the temperature oscillations of the specimen, was amplified by means of a selective amplifier and measured. The specific heat of the specimen was calculated from

$$mc = \frac{P}{2\omega V}\frac{dV}{dT}.$$

Here P and ω are the power and frequency of the current supplied to the specimen, V is the peak value of the variable voltage across the load resistance dV/dT is the derivative of the dependence of the voltage across the load resistance on specimen temperature.

The temperature of the specimen was determined from the radiated power on the basis of data on the emissivity of titanium [1].

In the figure the continuous line gives the results of our measurements of the specific heat of titanium in the range 1000–1300° K. These data are mean values of the results obtained with several specimens.

The error of the mean values does not exceed 3%. The circules represent data obtained by Backhurst [2] and the points with vertical bars the data of Holland [3].

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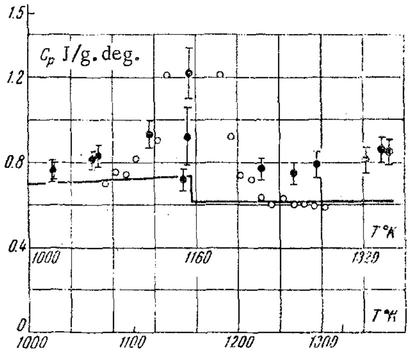

Fig. 1

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