PRECISION MEASUREMENTS OF THERMODYNAMIC PARAMETERS OF LOW-BOILING METALLIC LIQUIDS

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The results of an investigation of the thermophysical properties of cesium in the region of the anomalous behavior of these properties are given in [1] Interpretation of anomalies is difficult, because of the small magnitude of the effects. In the area of forced growth of the adiabatic thermal pressure coefficient (a.t.c.p.), the magnitude of the effect was 5% with a random error of 2%. The proposed work attempts to increase the accuracy of measurements. It is studied thermodynamic derivatives, namely a.t.c.p.

$$\chi = (\frac{1}{T})(\frac{\partial T}{\partial p})_s = \frac{\alpha_p}{c_p \rho} \tag{1}$$

where α_p-thermal expansion coefficient and $c_p\rho$ -heat capacity of the volume unit. For the measurement a unit is used in which the pressure change is carried out in a cicle mode. The software allows simultaneous averaging the values of the pressure oscillation amplitude and the amplitude of the temperature oscillation response with subsequent determination of their relationship. It is used in the unit an improved pressure modulator, allowing to create pressure oscillations form close to a sine wave (the value of the second harmonic is not more than 10%). The response temperature variations of the sample were recorded with the help of a precision nanovoltmeter RS–810 with synchronous digital detector. A supercapacitor (ionistor) of large capacity was used to separate the constant and periodic temperature signals, so that it became possible to record simultaneously the amplitude of pressure oscillations, the amplitude of the temperature oscillations of the sample and its current temperature. The technique currently used guarantees the determination of a.t.c.p. with a random error estimated at 0.5 –1%, which allows for a more complete study of the nature of the anomalies of thermodynamic parameters. Several series of the a.t.c.p. measurements were performed with liquid cesium in the temperature range of 320 - 620 K.

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1. L.A.Blagonravov, S.N.Skovorod'ko, A.S.Krylov, L.A.Orlov et al. Phase Transition in Liquid Cesium near 590 K // J.Non-Cryst Solids 277 (2000) 182-187.