ADIABATIC CALORIMETRY INVESTIGATION OF SUPERCOOLED STATE OF LIQUID WATER

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Using adiabatic calorimeter we have measured the temperature dependence of isobaric (at pressure 0.1 MPa) heat capacity of supercooled bulk water contained in sealed 1 ml glass ampoules up to temperature of 244 K. The measurements were carried out on heating from the low-temperature region with a rate of 0.4 K/hour. The anomalous increase in the isobaric heat capacity of supercooled water observed by us with lowering in temperature turned out to be very close to the data obtained using the analogous method by E. Tombari et al. [1]. Under the assumption of a power-law growth of the singular part of the heat capacity of the supercooled water with the critical index 3/2, corresponding to the initial fluctuation regime within the Landau-Brazovskii weak crystallization theory [2], the apparent temperature of the heat capacity divergence is of the order of 228.8 K. The latter value is just below the temperature of homogenous ice nucleation and is very close to temperatures of second critical point of water and the Widom line of the supercooled water heat capacity maximum at ambient pressure, predicted within the framework of the hypothesis of polyamorphism of liquid water [3]. Note however that above mentioned critical index of the heat capacity anomaly of supercooled water contradicts to the Ising universality class of the expected second critical point of water. We found a sharp increase in the relaxation time in supercooled water with a decrease in temperature, which did not allow us to conduct adiabatic measurements of the heat capacity at lower temperatures because of spontaneous freezing of bulk water. Our data on the isobaric heat capacity of bulk supercooled water in the temperature interval studied, like the analogous data of E. Tombary et al., lie above the data on the heat capacity of emulsified water obtained by C.A. Angell et al. [4] that until now are considered as the only true.

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