Semi-Phenomenological Approach to Confined Helium Heat Capacity in Mesopores.

K. Chalyy

Department of Medical and Biological Physics, National Medical University, Kiev, Ukraine

Influence of finite-size effect on the liquid helium ^{4}He heat capacity and the shift of the transition temperature are theoretically examined for the cases of cylindrical and slit-like geometry of mesopores. Correlating properties of the systems are studied in terms of the pair-correlation function and associated correlation length. It is shown that growth of the heat capacity taking place at the new transition temperature, which is calculated from the temperature dependence of correlation length within the present geometrical conditions. Specific features of the liquid helium heat capacity in the slit-like mesopores are studied with the effects of gravity and confinement taken into account. The contributions from the gravity effect and finite-size effect to the shift of transition temperature are examined. The calculated results were verified by comparison with available experimental data for the broad interval of diameters ranged from 30 nm to 8.17 μm in cylindrical pores and for the slit-like pores ranged in thickness from 48 nm to 57 μm. It is shown that the proposed approach gives the results that are in a reasonable quantitive agreement with the high-resolution confined helium experimental data, including those that were obtained under microgravity conditions.