Fluctuation effects in ^{3}He-^{4}He solid mixtures near the phase separation temperature

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Using the precision barometry method, temperature dependences of the pressure $P(T)$ in homogeneous solid ^{3}He-^{4}He mixtures have been studied in the wide range of concentrations above and below the equilibrium phase separation temperature T_s. An anomalous behavior of the pressure in the vicinity of T_s is found for all investigated samples. With decreasing temperature, as T_s is approached, the pressure increases instead of expected reduction due to decrease in the phonon contribution ($P_{ph} \sim T^4$). Such an increase in pressure continues in the metastable region below T_s until the mixture separates. Theoretical interpretation of the observed effects is proposed. The found pressure behavior can be described only with the consistent account for fluctuations in the impurity subsystem which near T_s dominates over phonon contribution into the pressure. The obtained theoretical results are in good quantitative agreement with the experimental data. Density fluctuations give rise to a spontaneous formation of impuriton nano-clusters containing several hundreds of atoms. This estimated size of the fluctuation nano-clusters agrees with the corresponding value obtained from the theory of homogeneous nucleation.