Critical Behavior of the Heat Capacity of Crystals in the Region of Incommensurate Phase Transitions

S.N. Kallaev [C, S]
Institute of Physics, Dagestan Scientific Center of Russian Academy of Sciences, Makhachkala, Russia

I.K. Kamilov
Institute of Physics, Dagestan Scientific Center of Russian Academy of Sciences, Makhachkala,, Russia

A.M. Aliev, Sh.B. Abdulvagidov, Amirova and A.B. Batdalov
Institute of Physics, Dagestan Scientific Center of Russian Academy of Sciences, Makhachkala, Russia

To explain the anomalies of heat capacity of ferroelectrics in the region of consecutive transitions "initial phase- incommensurate phase- polar phase," one usually invokes the Landau theory because of its remarkable simplicity. However, experimental studies of various physical properties in the region of second-order phase transition "initial phase-incommensurate phase" demonstrate dramatic deviations from the classical Landau behavior both above and below the transition. In this regard, the elucidation of the role of fluctuation effects in the transition to the incommensurate phases in crystals of different type is of fundamental importance. In this work the detailed experimental study of critical behaviour of specific heat of SC(NH2)2 and Rb2ZnCl4 crystals in the incommensurate phase transition region by ac-calorimetry method carried out. It is revealed, that in SC(NH2)2 crystal at  = (Ò/Òi-1) > 0 there is a range 1.0104 0.1810-2 with a critical exponent  = -0.0390.009, and at T < Ti - temperature range 2.510-4 0.9 10-2 with exponent ' = -0.04280.009. Observed derivations of the specific heat temperature dependence from the Landau theory near Ti are analyzed in the fluctuation theory framework using method developed by Levanyuk A.A. and co-authors [1]. It is shown, that the critical amplitudes relation of  is equal 1.44, that corresponds to theoretical estimations for XY - systems. Thus, the results of experimental studying of the specific heat and its analysis indicate, that there is a critical region in the vicinity of the incommensurate phase transition, where the anomalous behaviour agrees qualitatively with the theory making allowance for the critical fluctuations of order parameter.

[1] N. R. Ivanov, A. P. Levanyuk, S. A. Minyukov, et al., Ferroelectrics 96, 83 (1989).