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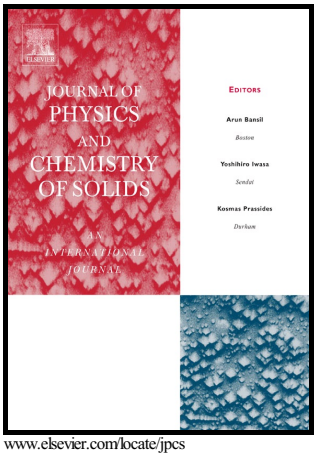

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Thermal diffusivity and 3D-XY critical behavior of ferroelectric semiconductors $(Pb_xSn_{1-x})_2P_2Se_6$

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Abstract

An ac photopyroelectric calorimeter has been used to study the thermal diffusivity of the ferroelectric semiconductors family $(Pb_xSn_{1-x})_2P_2Se_6$ (x=0 to 1) from 30 K to room temperature. Phase transitions have been found for x = 0, 0.05, 0.2, 0.47 but not for x=1 in the full temperature range. A continuous phase transition has been found for x = 0, 0.05, 0.2 and 0.47 which corresponds to the paraelectric commensurate to incommensurate phase. It has been possible to study the critical behavior of this transition for x=0, 0.05 and the critical parameters obtained have been α =-0.019, A^+/A^- =1.00 and α =-0.026, A^+/A^- =1.03, respectively, having fitted at the same time both the low and high temperature branches of the transition as rigorous critical theory indicates; these results agree with the theoretical prediction from renormalization group theory that this kind of transition complies with the 3D-XY universality class (α_{theor} =-0.014, A^+/A^- =1.06), which has been experimentally confirmed only in a few materials. A first order incommensurate to ferroelectric phase transition has been characterized in x=0, 0.05 at lower temperature.

Keywords: A. inorganic compounds; D. critical phenomena; D. ferroelectricity; D. phase transitions