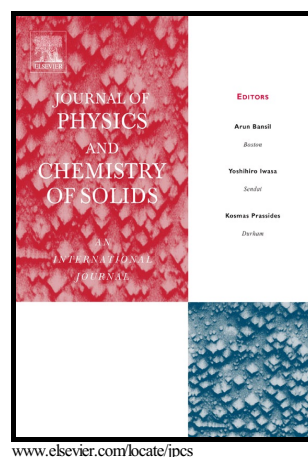


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PII: S0022-3697(15)30072-X
DOI: <http://dx.doi.org/10.1016/j.jpcs.2015.10.004>
Reference: PCS7644

To appear in: *Journal of Physical and Chemistry of Solids*

Received date: 28 July 2015
Revised date: 28 September 2015
Accepted date: 6 October 2015

Cite this article as: V. Shvalya, A. Oleaga, A. Salazar, A.A. Kohutych and Yu. M. Vysochanskii, Thermal diffusivity and 3d-XY critical behavior of ferroelectric semiconductors $(\text{Pb}_x\text{Sn}_{1-x})_2\text{P}_2\text{Se}_6$, *Journal of Physical and Chemistry of Solids*, <http://dx.doi.org/10.1016/j.jpcs.2015.10.004>

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Thermal diffusivity and 3D-XY critical behavior of ferroelectric semiconductors ($\text{Pb}_x\text{Sn}_{1-x}$) $_2\text{P}_2\text{Se}_6$

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Abstract

An ac photopyroelectric calorimeter has been used to study the thermal diffusivity of the ferroelectric semiconductors family ($\text{Pb}_x\text{Sn}_{1-x}$) $_2\text{P}_2\text{Se}_6$ ($x=0$ 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 $\alpha = -0.019$, $A^+/A^- = 1.00$ and $\alpha = -0.026$, $A^+/A^- = 1.03$, 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 ($\alpha_{theor} = -0.014$, $A^+/A^- = 1.06$), 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

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