Signature of field-induced spin ice state and evolution of structural and magnetic phase on La substitution in disordered pyrochlore oxide Dy_2Zr2O_7

S. Devi[1] and C.S. Yadav[1]

[1] *Indian Institute of Technology Mandi, Mandi-175005 (H.P.), India*

$Dy_2Zr_2O_7$ exhibits $Dy_2Ti_2O_7$ type high temperature magnetic field induced spin freezing near $\sim$ 10 K in ac susceptibility measurements [1]. The magnetic heat capacity of $Dy_2Zr_2O_7$ shows a correlation peak at 2 K, but no residual entropy was observed. The low-temperature magnetic entropy at 5 kOe field is R[ln2 - 1/2ln(3/2)] which is the same as for the spin ice state. Substitution of non-magnetic, isovalent La^{3+} for Dy^{3+} gradually induces the structural change from highly disordered fluorite to stable pyrochlore phase through a biphasic mixture of both. We observed that the higher La compositions ($1.5 \leq x \leq 1.9$), show spin freezing ($T \sim 17$ K) similar to the field induced spin ice freezing for low La compositions ($0 \leq x \leq 0.5$), and the well-known spin ice systems $Dy_2Ti_2O_7$ and $Ho_2Ti_2O_7$. The low temperature magnetic state for higher La compositions ($1.5 \leq x \leq 1.9$) culminates into spin glass state below 6 K. The Cole-Cole plot and Casimir-du Pr*é* fit shows narrow distribution of spin relaxation time in these compounds.

References:

[1] J. Snyder et al., Nature, 413, 48 (2001)