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Static magnetic susceptibility, crystal field and exchange interactions in rare earth titanate pyrochlores

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Abstract

The experimental temperature dependence ($T = 2\text{-}300\text{ K}$) of single crystal bulk and site susceptibilities of rare earth titanate pyrochlores $R_2Ti_2O_7$ ($R = \text{Sm, Eu, Gd, Tb, Dy, Ho, Er, Yb}$) is analyzed in the framework of crystal field theory and a mean field approximation. Analytical expressions for the site and bulk susceptibilities of the pyrochlore lattice are derived taking into account long range dipole-dipole interactions and anisotropic exchange interactions between the nearest neighbor rare earth ions. The sets of crystal field parameters and anisotropic exchange coupling constants have been determined and their variations along the lanthanide series are discussed. © 2010 IOP Publishing Ltd.

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