Magnetic Properties of Ce^{3+} Ions in Nb-Doped Cerium Dioxide

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Dilute magnetic oxides are currently attracting much attention in view of their potential for applications in spintronics and magneto-optical devices. In particular, it relates doped cerium dioxide where we have performed theoretical and experimental studies of crystal-field effects on magnetic properties of Nb-doped CeO_2. Using the crystallographic data for the abovementioned compound and the modified crystal- field theory, a novel computational approach, we have calculated energy levels of the Ce3+ ions and g-factor values.

It was found that the Γ8 ground state is separated from the overlying Γ7 state by 173 cm-1 in good agreement with the optical transmission data. With the g-factor value and related experimental data, we calculated the Curie-Weiss constant and get a percentage of Ce3+ ions in a mole of the substance. Comparison of calculated and experimentally measured temperature dependences of the magnetic susceptibility in Nb-doped and undoped cerium dioxide allows us to estimate the contribution of Ce3+ ions to the magnetism of the dilute magnetic oxide.