

Physical Review B - Condensed Matter and Materials Physics 2005 vol.71 N2

High-resolution optical spectroscopy investigation of Nd₂BaNiO₅ and Nd_{0.1}Y_{1.9}BaNiO₅ and crystal-field parameters for rare-earth linear-chain nickelates

Popova M., Klimin S., Chukalina E., Romanov E., Malkin B., Antic-Fidancev E., Mill B., Dhalenne G.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

High-resolution spectroscopy of Nd³⁺ in Nd₂BaNiO₅ and Y₂BaNiO₅:Nd(5%) powder samples is used to study Nd³⁺ crystal-field levels and exchange splittings in these quasi-one-dimensional model compounds. We demonstrate that the Nd³⁺ ground-state splitting in the magnetically ordered state of Nd₂BaNiO₅ ($T_N = 47.5 \pm 1$ K, as found from our spectroscopic data) accounts for the low-temperature magnetic properties and for the 4-meV mode observed earlier in inelastic neutron scattering experiments. Crystal-field analysis is performed. Its results show that the directions of ordered magnetic moments in Nd₂BaNiO₅ are determined by the single-ion anisotropy of Nd³⁺. We argue that the crystal-field parameters obtained for Nd-nickelate (in this work) and Er-nickelate (in our earlier work) can be used to predict the energy-level patterns and magnetic properties of other rare-earth linear-chain nickelates. ©2005 The American Physical Society.

<http://dx.doi.org/10.1103/PhysRevB.71.024414>
