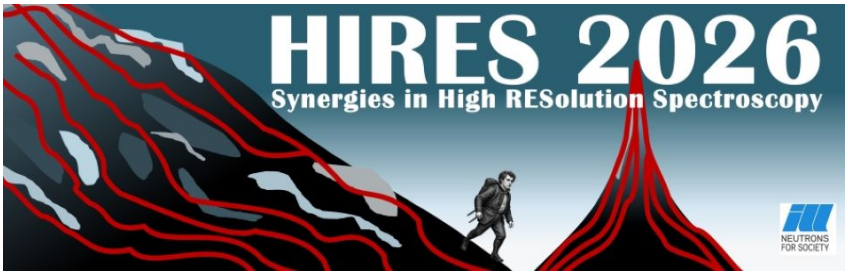

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Characterization of the magnetic phase transitions in double perovskite Nd2NiMnO6

Through neutron powder diffraction, we confirm the double perovskite Nd_2NiMnO_6 adopts a monoclinic $P2_1/n$ structure with nearly complete B-site ordering of Ni^{2+} and Mn^{4+}. Below T_1 = 198 K, magnetic susceptibility and neutron data reveal the Ni^{2+} and Mn^{4+} sublattices undergo ferromagnetic ordering, driven by strong 3d-3d exchange interactions. Upon cooling through T_2 = 22 K, a secondary transition occurs, where we discover an additional noncollinear, symmetry-breaking order of Nd^{3+} moments. We propose this rare-earth canting stems from the competition between f-d and f-f Heisenberg exchanges, finely balanced in the perovskite framework. The ground state symmetry also implies significant Nd^{3+} easy-plane anisotropy and a decoupling of the antiferromagnetic spin canting from the transition metal lattice.
Between T_1 and T_2, anomalous frequency-dependent ac susceptibility appears, characteristic of reentrant spin-glass-like behavior, attributed to antisite disorder and competing interactions. Furthermore, analysis of isothermal magnetization reveals magnetic entropy changes, suggesting potential for magnetic refrigeration. A peak entropy change of 2.25 J $kg^{-1}K^{-1}$ at T_1 under a 7 T field was observed. The scaling of this entropy, alongside other critical exponents, confirms the ferromagnetic transition at T_1 is a mean-field second-order phase transition. Collectively, our results provide crucial details on Nd_2NiMnO_6's magnetism, reinforcing double perovskites as model systems for studying competing interactions, magnetocaloric effects, and reentrant spin-glass phenomena

Session

Magnetism

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