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ABSTRACT

NdFeO3: An Interesting Interplay between two Distinct Magnetic Sublattices

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Coupled magnetic sublattices of different cations, ordering with different spin structures, yield macroscopic states more easily controlled by external stimuli. This possibility makes these systems attractive for emerging information technologies. The magnetic anisotropy character of the 4*f*-electron shell, along with the crosstalk between 3*d*- and 4*f*-sublattices makes $NdFeO_3$ a model system to explore the impact of external magnetic fields on the magnetic structures in different coupled magnetic sublattices. Here, we report the occurrence of two distinct magnetic field-induced phase transitions in $NdFeO_3$ related to changes in temperature, and in the direction and strength of the applied magnetic field. These include the interchange between the two known Γ_4 and Γ_2 spin structures, and the appearance of a hitherto unknown high-field-induced spin-flop transition, observed below 100 K when the applied field is directed along the *c*-axis. Based on magnetic field dependent Raman and polarized THz studies of magnon spectra and isothermal magnetization, we draw a phase diagram. The overall picture here reported is expected to be valid in general for other rare-earth orthoferrites with spin-reorientation transitions, and it may apply extendable, as well, to other systems with non-equivalent magnetic sublattices.

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