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Magnetic order, spontaneous polarization, and magnetoelectric effect in rare earth iron borates: $\mathbf{Ho_{1-x}Nd_xFe_3(BO_3)_4}$ B. LORENZ, R. P. CHAUDHURY, Y. Y. SUN, TCSUH and Dept. of Physics, University of Houston, C. R. DELA CRUZ[1], Dept. of Physics and Astronomy. University of Tennessee, L. N. BEZMATERNYKH, V. L. TEMEROV, Inst. of Physics, Siberian Div., RAS, C. W. CHU[2], TCSUH and Dept. of Physics, University of Houston — Comprehensive results are presented for the thermodynamic, magnetic, dielectric, and magnetoelectric properties of $HoFe_3(BO_3)_4$ and the solid solution $Ho_{1-x}Nd_xFe_3(BO_3)_4$ (x = 0.5 and 0.75). All compounds undergo a Neél order at $T_N > 30$ K and a spin reorientation at $T_{SR} < 10$ K. $HoFe_3(BO_3)_4$ shows a spontaneous electrical polarization below T_N which decreases below T_{SR} and in external magnetic fields. $Ho_{1-x}Nd_xFe_3(BO_3)_4$ exhibits both, a spontaneous polarization and a large positive magnetoelectric effect. The superposition of spontaneous polarization induced by the internal magnetic field and the magnetoelectric polarization in external fields results in a complex behavior of the electrical polarization as function of temperature and/or magnetic fields. The magnetic order of $HoFe_3(BO_3)_4$ is further explored by neutron scattering experiments in external magnetic fields.

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