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Ground State Properties and Magnetodielectric Coupling in $Sm_{0.5}Nd_{0.5}Fe_3(BO_3)_4$[1] C.S. NELSON, Brookhaven National Laboratory, Upton, NY, USA, R.P.S.M. LOBO, LPEM, ESPCI, CNRS, UPMC, Paris, France, L.N. BEZMATERNYKH, Kirensky Institute of Physics, Siberian Branch of RAS, Russia — We report x-ray scattering and polarized infrared reflectivity measurements of the substituted ferroborate $Sm_{0.5}Nd_{0.5}Fe_3(BO_3)_4$. Below $T_N = 33$ K, a new set of commensurate peaks with resonant enhancements at the rare earth L edges indicates a doubling of the magnetic structure along the c-axis and simultaneous ordering of the rare earth and iron ions. Rare earth spin polarizations decrease rapidly with increasing temperature, in contrast to that of the iron ions. Shell-specific measurements of the rare earth spin polarizations indicate similar behaviors of the Sm and Nd 5d states, while the Sm 4f and 5d states have different temperature dependences. Along the c-axis we observe negative thermal expansion below ∼75 K and a strong phonon softening from room temperature down to T_N, at which it freezes in frequency. Also at T_N we observe the appearance of an electromagnon in the ab-plane that gets its spectral weight from the lowest frequency phonon. These results indicate a lattice instability linked to magnetism with a strong coupling between magnetic and elastic properties.

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