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Multiferroicity of $\text{RMn}_{1-x}\text{Ga}_x\text{O}_3$ ($\text{R} = \text{Ho}, \text{Y}$) and $\text{Ho}_{1-x}\text{Y}_x\text{MnO}_3$
H.D. ZHOU, J.C. DENYSZYN, JOHN. B. GOODENOUGH, The University of Texas at Austin — $\text{RMn}_{1-x}\text{Ga}_x\text{O}_3$ ($\text{R} = \text{Ho}$ or Y) and $\text{Ho}_{1-x}\text{Y}_x\text{MnO}_3$ single-crystals have been prepared. The experimental results revealed that the c axis decreases with increasing temperature with a larger $|dc/dT|$ above T_C than below it. This shows that the cooperative MnO_5 site rotations responsible for the ferrielectricity expend energy to induce the ferroic R^{3+} -ion displacements along the c axis. Ga doping raises the ferrielectric Curie temperature T_C and the Mn-spin reorientation temperature T_{SR} while lowering T_N of the Mn spins and the Ho magnetic ordering temperature T_2 . The data show (i) an important coupling between the Mn^{3+} -ion and Ho^{3+} -ion spins; (ii) a T_{SR} that is driven by the cooperative MnO_5 site rotation and R^{3+} -ion displacements that control the c lattice parameter. Y doping favors the formation of $P6'_3cm'$ magnetic phase below T_N , and enhances the temperature region of $P6'_3cm'$ phase. Therefore, T_{SR} for the transition from $P6'_3c'm$ to $P6'_3cm'$ phase increases with increasing x , but T_{SR} disappears for $x > 0.8$ samples because the $P6'_3cm'$ phase already occupies the whole temperature region below T_N . The thermal conductivity data also support an enhanced spin-lattice interaction above T_N in the geometrically frustrated (GF) Mn-spin system.

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