Antiferromagnetism and magnetocaloric effects in $GdCrO_3$ based compounds

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Here we present a comparative study of the structural, magnetic, and magnetocaloric properties of polycrystalline rare-earth chromite ($RCrO_3$) compounds, focusing on the effect of Gd-site or Cr-site substitutions on the caloric properties of $GdCrO_3$. For this work, the bulk powder/pellets were synthesized by the citrate solution route. $RCrO_3$ materials were found to stabilize in orthorhombically distorted perovskite structure. The ionic radii, orthorhombic strain, in-plane & out-of-plane $Cr-O_1-Cr$ bond angles, bond lengths, all influences the *Néel* temperature (T_N^{Cr}) and magnetocaloric properties of the compounds. For example, the Néel temperature changes from 155 K for $Er_{0.33}Gd_{0.67}CrO_3$, to 167 K for $GdCrO_3$ and 275 K for $GdFe_{0.5}Cr_{0.5}O_3$. The maximum value of magnetic entropy change ($-\Delta S$) at 7 T for $Er_{0.33}Gd_{0.67}CrO_3$, $GdCrO_3$ and $GdFe_{0.5}Cr_{0.5}O_3$ were 10.7 $J\,kg^{-1}K^{-1}$ (at 15 K), 31.5 $J\,kg^{-1}K^{-1}$ (at 5 K), and 30.7 $J\,kg^{-1}K^{-1}$, respectively. Corresponding relative cooling power were 416.4 $J\,kg^{-1}$, 531.1 $J\,kg^{-1}$, and 566.5 $J\,kg^{-1}$, respectively. Details and discussion of these results along with those of Cr-doped samples will be presented.