

Magnetic properties and magnetocaloric effect of $\text{HoCo}_{3-x}\text{Al}_x$ compounds

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The $\text{HoCo}_{3-x}\text{Al}_x$ compounds with $x = 0.4$ crystallize in a rhombohedral structure having $R\bar{3}m$ space group. The lattice parameters decrease slowly when aluminium atoms substitute the cobalt atoms. This fact can be attributed to lower Al ionic radius.

The magnetic measurements were performed in external magnetic fields up to 12T in the temperature range 4.2-700K. The saturation magnetization, at 4.2 K, increases slowly as cobalt is replaced by aluminium from $5.93 \mu_B/\text{f.u.}$ ($x=0$) to $6.46 \mu_B/\text{f.u.}$ ($x=0.4$) in agreement with antiparallel ordering of Ho and Co sublattices. The Curie temperature decreases from 435 K ($x=0$) to 287 K for the compound with $x=0.4$.

The magnetic behaviour of cobalt was analyzed in the spin fluctuation model. The adiabatic magnetic entropy changes, $|\Delta S|$, were determined from magnetization data. Large $|\Delta S|_{max}$ values were obtained in all cases. The origin of the large magnetic entropy change could be attributed to the considerable variation of the magnetization near the transition temperature. The potential application of these compounds as working substance for magnetic refrigeration is discussed.

← 13.4 cm →

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9.7 cm