Magnetic and transport properties of $NiMn_{2-x}Co_xO_4$ spinel oxides

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The spinel compound $NiMn_2O_4$ has been the subject of numerous investigations and constitutes, in particular, a model material for potential applications in the field of NTCR thermistors. From the magnetic point of view, the partial substitution of the Mn cations by other transition elements, according to the relation $NiMn_{2-x}Me_xO_4$ (*Me* = Co, Zn, Fe, Cr, …), leads to some interesting situations. In this work, we have synthesized spinel oxides with the general formula $NiMn_{2-x}Co_xO_4$, and characterized them by x-ray diffraction and magnetization measurements. The paramagnetic moment evaluated in the range [200 K ≤ T ≤ 400 K], shows a direct correlation with the nominal cation concentration. A first magnetic transition at $T = T_c$ depends on the overall composition, going from 120 K ($NiMn_{1.8}Co_{0.2}O_4$) up to 210 K. A second transition is observed at lower temperature; this second transition takes place at about 60 K ($NiMn_{1.4}Co_{0.6}O_4$), and increases with the Co content up to 160 K. Under an external field, both transitions merge into a single one, with a characteristic temperature T_{max} rapidly decreasing with increasing fields. Magnetization loops M(H) obtained at 5 K show the typical behaviour of ferrimagnets. Preliminary measurements of the electrical resistance show a reasonably good conductivity in the ordered state(s). Present investigations of ρ(T,H) under different applied fields point towards the determination of novel magneto-transport phenomena in these materials.

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