Thermal Properties of the (Nd,Ca)$BaCo_2O_{5.5}$ Materials

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Layered cobaltites $R\mathrm{BaCo_2O_{5.5}}$, which are considered as potential materials for fuel cells cathodes, exhibit a rich spectrum of magnetic and electronic properties. By substituting Ca^{2+} ions (which have nearly identical ionic radius as Nd^{3+}) for Nd^{3+} in $(\mathrm{Nd_{1-x}Ca_x})\mathrm{BaCo_2O_{5.5}}$, the hole doping has been realized without disturbing the crystalline structure and the ordering of oxygen vacancies. Thus, we were able to study the influence of hole doping alone on thermal and magnetic properties for compounds with $x = 0 - 0.2$. Specific heat of the synthesized samples was measured over the temperature range from 2 to 395 K in magnetic field of 0 and 7 T. The lattice and magnon contributions to the specific heat were separated and described theoretically by using the Debye and the Einstein models for the lattice contribution and by using a model of magnons in anisotropic materials for the magnon contribution.

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