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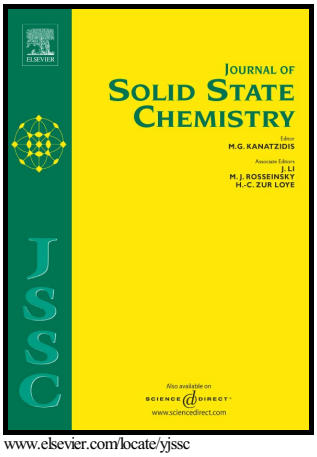

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Perovskite solid solutions $La_{0.75}Bi_{0.25}Fe_{1-x}Cr_xO_3$: preparation, structural, and magnetic properties

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Abstract

Solid solutions of $La_{0.75}Bi_{0.25}Fe_{1-x}Cr_xO_3$ (x = 0.1, 0.25, 0.5, and 0.75) prepared by conventional solid state reaction have been studied by means of X-ray powder diffraction (XRPD), neutron powder diffraction (NPD) and magnetic measurements. The NPD and XRPD patterns indicate orthorhombic structure (space group *Pnma*) for all compositions in the whole temperature range investigated (4-900 K). The lattice parameters of $La_{0.75}Bi_{0.25}Fe_{1-x}Cr_xO_3$ were found to decrease with the Cr content. It was established that the Fe^{3+} and Cr^{3+} cations are randomly positioned at the *B*-site of the perovskite structure.

All samples order antiferromagnetically below transition temperatures that decrease with increasing Cr content, from around 700 K for x = 0.1 to about 300 K for x = 0.75. The antiferromagnetic arrangement of the Fe^{3+}/Cr^{3+} magnetic moments in the *B*-site is of *G*-type along the *x*-axis (*Gx* mode) with propagation vector k = (0,0,0) for all concentrations of Cr. Effects of the composition on several structural distortion parameters were investigated and an anomalous variation of the octahedral deformation with Cr content was found. Whilst the overall octahedral deformation varies irregularly with increasing Cr content, the octahedral tilting was found to decrease monotoneously.

Graphical abstract

Left: Representations of the (top) crystal and (bottom) magnetic structure of $La_{0.75}Bi_{0.25}Fe_{1-x}Cr_xO_3$.
Right: Temperature dependence of the Fe/Cr-site magnetic moment extracted from NPD data.