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The Mössbauer study of magnetic phase transition in single crystal $(Nd_{1-x}Sm_x)_{1/3}Sr_{2/3}FeO_3$

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Abstract

$(Nd_{1-x}Sm_x)_{1/3}Sr_{2/3}FeO_3$ were synthesized and their charge ordering (CO) transition related to lattice distortion was systematically investigated. The canted antiferromagnetic spin ordering exists below Néel temperature (T_N). This phase transition is accompanied by charge disproportionation into nominally Fe^{3+} and Fe^{5+}. The CO, a sequence of Fe^{+3} Fe^{+3} Fe^{+5} Fe^{+3} Fe^{+3} $Fe^{+3}Fe^{+5}$, which exists align the [1 1 1] direction of pseudo cubic perovskite. The three kinds of iron, Fe^{3+}, Fe^{5+} and Fe^{4+}, are found below T_N. The amount of Fe^{4+} increases from 13% to 66% as temperature increases. This can be interpreted to mean that the charge ordering and disordering phase coexists. The charge ordering state is realized by strong hybridization between Fe and O atoms. The Néel temperature decreases with the increase of the Sm concentration.

Keywords: Mössbauer spectroscopy; Charge ordering (CO); Phase transition; Charge disproportionation (CD)