

Structural Aspects of the Charge Disproportionation Transition in $\text{La}_x\text{Sr}_{1-x}\text{FeO}_{3-y}$ ($x = 1/10, 1/3, \text{ and } 1/2$)

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The aspects of the charge disproportionation transition for polycrystalline $\text{La}_x\text{Sr}_{1-x}\text{FeO}_{3-y}$ ($x = 1/2, 1/3, \text{ and } 1/10$) near the transition temperature are investigated using Mössbauerspectroscopy in relevance with their chemical and crystallographic data.

As the lanthanum content x is increased, both the rhombohedral lattice constant a_R and the edge angle α_R increase, resulting in a slight increase in the tolerance factor t . For $x = 1/3$, a first-order-like transition between the low-temperature antiferromagnetic mixed-valence state and the high-temperature paramagnetic average-valence state takes place in the temperature range between 175 K and 200 K. With an increase in x from $1/3$ to $1/2$, this transition becomes blurred by the weakened p - d hybridization due to the slight decrease in the bond angle ($\angle\text{Fe-O-Fe}$) from 180° with its transition temperature effectively unchanged. For the case of $x = 1/10$, the electron delocalization takes place at considerably low temperature, and $\text{La}_x\text{Sr}_{1-x}\text{FeO}_{3-y}$ is paramagnetic in the temperature region examined. This comes from a reduction of electron transfer energy due to contractions in the bond lengths.

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