

Effect of Ni Substitution on the Antiferromagnetic Ordering in Olivine $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$

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(Received 12 January 2011, in final form 22 February 2011)

Ni-doped $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ polycrystalline samples were prepared by using the solid-state reaction method in order to investigate the effect of Ni substitution in antiferromagnetic $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ system by using a superconducting quantum interference device (SQUID) magnetometer and Mössbauer spectroscopy. The crystal structure was determined to be orthorhombic with the space group $Pnma$ for all $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ samples. The magnetic order for all $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ samples was antiferromagnetic with different superexchange interactions. From the analyzed Mössbauer spectra, the value of the hyperfine field for $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ decreased with increasing Ni substitution at temperatures ranging from 4.2 K to below the Néel temperature. This result suggests that the Fe-O-Fe superexchange interaction is larger than that of the Fe-O-Ni link. Moreover, we found that Ni ions in $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ could induce an asymmetric charge density in the FeO_6 octahedral site due to the charge on distant Ni ions.

PACS numbers: 75.50.Ee, 75.30.Et, 76.80.+y, 61.10.-i

Keywords: Antiferromagnetics, Superexchange interaction, Mössbauer effect

DOI: 10.3938/jkps.58.801