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Abstracts

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The magnetic properties of Ni-doped LiFePO_4

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The effects of Ni substitution on the magnetic properties in the $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ ($0.0 \leq x \leq 0.6$) have been investigated by x-ray diffraction, superconducting quantum interference device (SQUID) magnetometry and Mössbauer spectroscopy. The XRD patterns of all the $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ samples are indicated single phase orthorhombic structure (Space group: $Pnma$).

The temperature dependent magnetic susceptibility for the $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ show antiferromagnetic [1] behavior in which $\text{Ni}^{2+}(3d^8)$ and $\text{Fe}^{2+}(3d^6)$ ions are aligned antiparallel spin state. The magnetic Néel temperatures are determined to be 51 K for $x = 0.0$, 48 K for $x = 0.2$, and 43 K for $x = 0.4$, respectively, from the magnetic susceptibility curves and Mössbauer spectra.

The Mössbauer spectra of the samples show asymmetrical 8-line patterns which is analyzed by diagonalizing the 4×4 magnetic and quadrupole Hamiltonian matrix as shown in Figure 1. The magnetic hyperfine field (H_{hf}) decreased from 135 kOe to 120 kOe with increase of Ni concentration from $x=0.0$ to $x=0.6$ at 4.2 K. The result can be explained that the effect of Ni substitution can be induced weaker superexchange interaction than that of between the Fe ions.

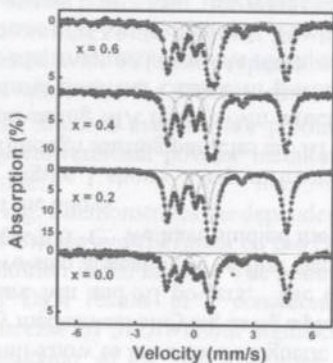


Fig 1. The Mössbauer spectra of $\text{LiFe}_{1-x}\text{Ni}_x\text{PO}_4$ ($0.0 \leq x \leq 0.6$) at 4.2 K.