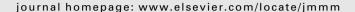


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Synthesis and magnetic properties of LiFePO₄ substitution magnesium



Hyunkyung Choi^a, Min Ji Kim^a, Eun Joo Hahn^b, Sam Jin Kim^a, Chul Sung Kim^{a,*}

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ABSTRACT

LiFe_{0.9}Mg_{0.1}PO₄ sample was prepared by using a solid–state reaction method, and the temperature-dependent magnetic properties of the sample were studied. The X-ray diffraction (XRD) pattern showed an olivine-type orthorhombic structure with space group *Pnma* based on Rietveld refinement method. The effect of Mg substitution in antiferromagnetic LiFe_{0.9}Mg_{0.1}PO₄ was investigated using a vibrating sample magnetometer (VSM) and Mössbauer spectroscopy. The temperature-dependence of the magnetization curves of LiFe_{0.9}Mg_{0.1}PO₄ shows abnormal antiferromagnetic behavior with ordering temperature. Sudden changes in both the magnetic hyperfine field (H_{hf}) and its slope below 15 K suggest that magnetic phase transition associated to the abrupt occurrence of spin-reorientation. The Néel temperature (T_{N}) and spin-reorientation temperature (T_{S}) of LiFe_{0.9}Mg_{0.1}PO₄ are lower than those of pure LiFePO₄ (T_{N} = 51 K, T_{S} = 23 K). This is due to the Fe–O–Fe superexchange interaction being larger than that of the Fe–O–Mg link. Also, we have confirmed a change in the electric quadrupole splitting (Δ E_Q) by the spin-orbit coupling effect and the shape of Mössbauer spectrum has provided the evidence for T_{S} and a strong crystalline field. We have found that Mg ions in LiFe_{0.9}Mg_{0.1}PO₄ induce an asymmetric charge density due to the presence of Mg²⁺ ions at the FeO₆ octahedral sites.

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^a Department of Physics, Kookmin University, Seoul 02707, South Korea

^b Department of Physics, Suwon University, Suwon 18323, South Korea