

Mn doping on Mössbauer spectroscopy of maricite- NaFePO_4 as cathode material

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Transition metal ion substitution in sodium phosphate is effective in enhancing the performance of a cathode material. Samples of Mn-doped maricite- $\text{NaFe}_{1-x}\text{Mn}_x\text{PO}_4$ ($x = 0.1, 0.2, 0.3, 0.4,$ and 0.5) were synthesized using solid-state procedures. The crystallographic and magnetic effects of the Mn substitution were investigated through x-ray diffraction (XRD), a vibrating sample magnetometer, and Mössbauer spectroscopy. The XRD patterns of $\text{NaFe}_{1-x}\text{Mn}_x\text{PO}_4$ revealed an orthorhombic structure with a space group of $Pmnb$. The lattice constants and bond lengths between Fe-O ions of $\text{NaFe}_{1-x}\text{Mn}_x\text{PO}_4$ increased by increasing the Mn substitutions. The temperature dependence of the magnetization curves for $\text{NaFe}_{1-x}\text{Mn}_x\text{PO}_4$ decreased with an increase in the Mn substitutions, indicating a weakened antiferromagnetic interaction. The Mössbauer spectra exhibited asymmetrical line shapes below the Néel temperature (T_N) and were fitted with eight Lorentzian lines, owing to a strong crystalline field in the distorted $\text{Fe}(\text{Mn})\text{O}_6$ octahedral site. The spectra also displayed a doublet absorption line at 295 K.

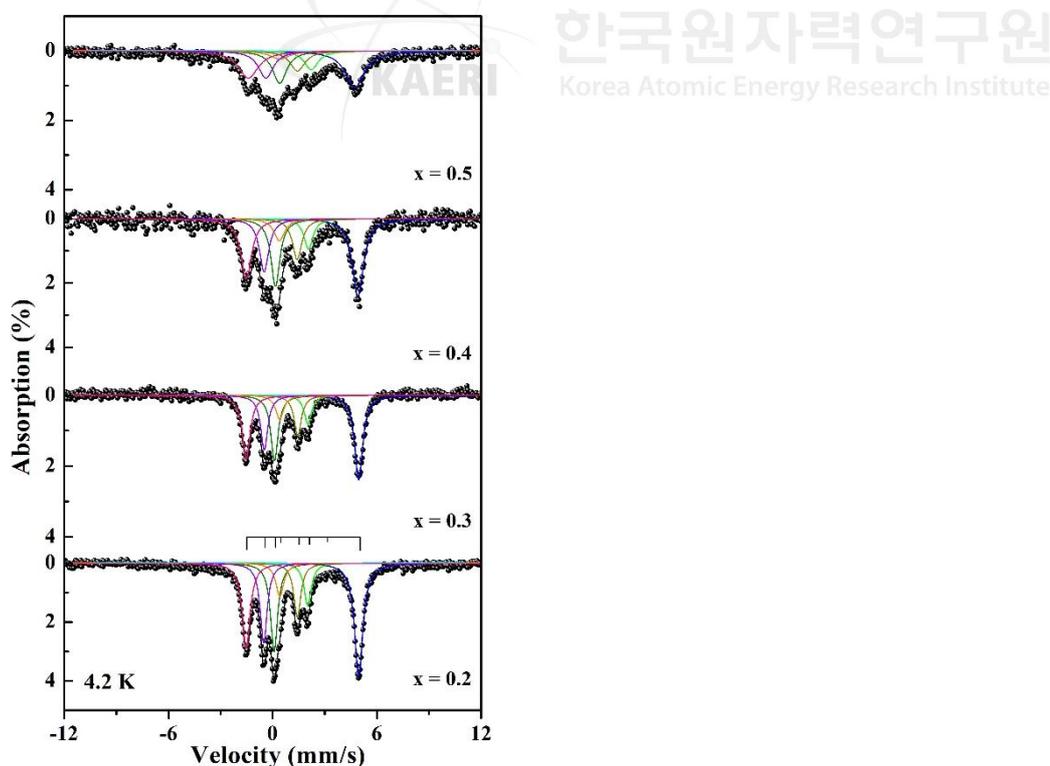


Fig. 1. Mössbauer spectra of maricite- $\text{NaFe}_{1-x}\text{Mn}_x\text{PO}_4$ ($x = 0.2, 0.3, 0.4,$ and 0.5) at 4.2 K.

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