

Magnetic properties of mixed sodium-lithium iron fluorophosphate $\text{NaLiFePO}_4\text{F}$ cathode material

Jae Yeon Seo, Hyunkyung Choi, and Chul Sung Kim^a

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

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Mixed sodium-lithium iron fluorophosphates $\text{NaLiFePO}_4\text{F}$ was synthesized by solid-state route. The crystal and magnetic properties were investigated by X-ray diffraction (XRD) measurement, vibrating sample magnetometer (VSM), and Mössbauer spectroscopy. The crystal structure of $\text{NaLiFePO}_4\text{F}$ was determined to be orthorhombic with space group of $Pnma$. The cell parameters of $\text{NaLiFePO}_4\text{F}$ are as follows: $a_0 = 10.9661 \text{ \AA}$, $b_0 = 6.3693 \text{ \AA}$, $c_0 = 11.4342 \text{ \AA}$, and $V = 798.6377 \text{ \AA}^3$. The temperature-dependence of the zero-field-cooled (ZFC) and field-cooled (FC) curves was examined by VSM at 100 Oe from 4.2 to 295 K. We determined the Néel temperature ($T_N = 22 \text{ K}$) and spin reorientation temperature ($T_S = 13 \text{ K}$). The Mössbauer spectra of $\text{NaLiFePO}_4\text{F}$ were taken at various temperatures ranging from 4.2 to 295 K. At below T_S , the electric quadrupole splitting (ΔE_Q) decreased and magnetic hyperfine field (H_{hf}) increased with decrease temperature due to spin-orbit coupling. © 2018 Author(s). All article content, except where otherwise noted, is licensed under a Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>). <https://doi.org/10.1063/1.5043038>