

Temperature-Dependent Magnetic Property of Olivine LiFePO_4

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We have investigated the structural and the magnetic properties of LiFePO_4 with emphasis on the state of the Fe ion with temperature variation. A LiFePO_4 composite was prepared by using the solid state method. The lattice constants were determined to be $a_0 = 10.329$, $b_0 = 6.006$ and $c_0 = 4.698$ Å with orthorhombic ($Pnma$) structure. The Mössbauer spectrum of olivine LiFePO_4 at room temperature show only a single doublet with an isomer shift (δ) of 1.1 mm/s and an electric quadrupole splitting (ΔE_Q) of 2.97 mm/s. The Néel temperature was observed at 51 K by using Mössbauer spectroscopy. We have described the abnormal line broadening at temperatures bellow T_N , in terms of the temperature dependence of the cancellation effect between the orbital current field term and the Fermi contact term in the magnetic hyperfine field (H_{hf}). The values of the isomer shift indicate that, for temperatures between 4.2 K and 297 K, the state of Fe ions is ferrous (Fe^{+2}). The Debye temperature of the LiFePO_4 was found to be $\Theta = 701 \pm 5$ K.

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