

Two-step development of antiferromagnetic order in LiNiPO_4

S. Lewinska,¹ Yu. Kharchenko,² M.U. Gutowska,¹ A. Szewczyk,¹
M.F. Kharchenko,² and R. Puzniak¹

¹*Institute of Physics, Polish Academy of Sciences, Warsaw, Poland*

²*B. Verkin ILTPE, National Academy of Sciences of Ukraine, Kharkiv, Ukraine*

Among orthorhombic olivines, promising for application as cathodes in Li-ion batteries and showing a large linear magnetoelectric effect, LiNiPO_4 is the most intriguing compound, because an antiferromagnetic ordering develops in it in two steps. On cooling, there appear a second order transition to an incommensurate antiferromagnetic, IC, phase at 21.8 K, and next, at 20.9 K, a first order transition to a commensurate antiferromagnetic, C, phase. To elucidate nature of these transitions and their evolution in magnetic field (i) temperature dependences of specific heat at several values of magnetic field (applied along different crystallographic axes), and (ii) angular dependences of magnetic torque and magnetization for the magnetic field rotating within a - c and b - c planes (for several temperatures and magnetic field values) were measured for the LiNiPO_4 single crystal. A splitting of a sharp specific heat anomaly accompanying the IC-C transition was found and interpreted as indication that the appearance of the C phase is coupled to the appearance of a non-zero electric polarization.

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