Magnetic phase transition and spin dynamics in Li(Ni1-xFex)PO4

JIYING LI, DAVID VAKNIN, JEREL ZARESTKY, Ames Laboratory and Department of Physics and Astronomy, Iowa State University, Ames IA 50011, JAE-HO CHUNG, NIST Center for Neutron Research, National Institute of Standards and Technology, Gaithersburg, MD 20899 — Elastic and inelastic neutron scattering techniques were used to study the magnetic phase transition and spin dynamics in pure and Fe substituted LiNiPO4 single crystals. Pure LiNiPO4 undergoes a first-order magnetic phase transition from a long-range ordered incommensurate phase to an antiferromagnetic ground state at TN = 20.8 K. With the substitution of Fe for Ni, the magnetic phase transition changes from first-order to second-order, and moreover, the long-range ordered incommensurate phase of pure LiNiPO4 between 20.8 K to 21.5 K was suppressed in the LiNi0.75Fe0.15PO4 sample. Inelastic neutron scattering revealed a 2 meV energy gap and an anomalous soft mode in the spin wave dispersion curve along the [010] direction for pure LiNiPO4. For LiNi0.8Fe0.2PO4, however, the energy gap was reduced to 0.9 meV and the anomaly along the [010] direction reduced. The spin-wave dispersion curves were simulated using a Heisenberg Hamiltonian with Dzyaloshinski-Moriya interactions.

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