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Crystallographic and Magnetic Properties of $LiCoPO_4$

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The $LiCoPO_4$ has been studied for magnetoelectric effect material [1] and cathode material for Li-ion battery. Recently, various magnetic phenomena were observed in $LiCoPO_4$ at low temperature [2, 3]. Polycrystalline $LiCoPO_4$ powder was synthesized by a solid-state reaction method. The temperature dependence of crystal structure was analyzed using by HRPD (high resolution powder neutron diffraction) at various temperatures, as shown in Fig. 1. The octahedron with cobalt and six oxygen ions was distorted to one axis direction at low temperature. Lattice constants a_0, b_0, and c_0 were determined to be 10.172 Å, 5.900 Å, 4.683 Å at 4 K, respectively. The temperature dependence of magnetization was measured using by SQUID (superconducting quantum interference device) magnetometer at temperatures ranging from 5 to 300K. Although $LiCoPO_4$ shows anti-ferromagnetic behavior, rapid increasing of magnetization was observed below 9 K and large coercivity observed at 5 K, which was determined to be 335 Oe. Néel temperature (T_N) of $LiCoPO_4$ was determined to be 23 K.

[1] Wei Tian, et al., Phys. Rev. B, **78**, 184429, 2008.
[2] D. Vaknin, et al., Phys. Rev. B, **65**, 224414, 2002.
[3] Bas B. V. Aken, J. –P. Rivera, H. Schmid and M. Fiebig, Nature, **449**, 702, 2007.

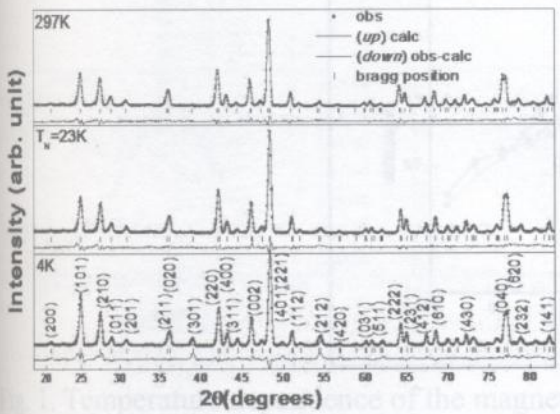

Fig. 1. Neutron diffraction patterns for $LiCoPO_4$ from 4 to 297K.