Electric polarization of $LiCoPO_4$ in pulsed magnetic field

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Lithium cobalt orthophosphate is well known Ising-like magnetoelectric antiferromagnet. Actually, it is a very weak ferromagnet below $T_N = 21.7$K. In a strong magnetic field it exhibits complex multistep phase transformation from antiferromagnetic state to a saturated paramagnetic one. To obtain additional information about the symmetry of the magnetic structures forming during field-induced spin reorientations the electric polarization, along the crystallographic $a||x$ axis, was measured in pulsed magnetic field with magnitude up to 280 kOe at $T = 4.2$K. The magnetic field was applied along the crystallographic $b||y$ axis. The magnetically induced electric polarization disappeared at the first transition field $H_1 = 121$ kOe and reappeared in the vicinity of the second one ($H_2 = 226$ kOe). The polarization finally disappeared at the phase transition to the saturated paramagnetic state ($H_3 \approx 276$ kOe). These results are in rather good agreement with the polarization measurements in DC magnetic field below 10 kOe. The possible magnetic structures formed in magnetic field during the spin reorientation and their symmetries will be discussed.