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Multiferroic Domain Switching in Canted Antiferromagnetic Conical Spin Chains

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Magnetic domain switching induced by magnetic and electric fields was investigated in the olivine Mn_2GeO_4 showing both weak ferromagnetism and ferroelectricity, i.e., multiferroicity. The ground-state magnetic structure of this compound can be regarded as canted antiferromagnetic conical spin chains in which incommensurate spiral and canted commensurate spin structure components coexist and magnetically-induced ferroelectric polarization develops in the direction parallel to net magnetization. Unpolarized and polarized neutron scattering measurements after applying magnetic and/or electric fields revealed close correlation between domains ascribed to the commensurate and incommensurate components and the nature of field-induced multiferroic domain switching. The results clarify the mechanism of simultaneous reversal of the magnetization and the ferroelectric polarization in the light of a flop of the cone axis in the conical spin chains.