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Magnetoelectric Effects and Related Phenomena in Spin-spiral Hexaferrites

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Among various multiferroics, extensive studies of ferroelectrics originating from magnetic orders, i.e., *magnetically-induced ferroelectrics* in which the inversion simmetry breaking and resultant ferroelectricity are induced by complex magnetic orders, have been triggered almost a decade ago by the discovery of multiferroic nature in a perovskite-type rare-earh manganites $TbMnO_3$. The magnetically-induced ferroelectrics often show giant magnetoelectric effects, remarkable changes in electric polarization in response to a magnetic field, since the origin of their ferroelectricity is driven by magnetism which sensitively responds to an applied magnetic field. Though a large number of new magnetically-induced ferroelectrics have been reported in the past decade, so far there has been no practical application employing the magnetoelectric effect of the magnetically-induced ferroelectrics. This is partly because none of the existing magnetically-induced ferroelectrics have combined large and robust electric and magnetic polarizations at room temperature until quite recently. The situation is changed by the discoveries of magnetoelectricity in hexagonal ferrites (*hexaferrites*) with spin-spiral structures.[1,2,3] In this presentation, I show our recent studies on magnetoelectric effects and related phenomena in the new series of magnetically-induced ferroelectrics which are promising candidates for multiferroics operating at room temperature and low fields. This work has been done in collaboration with Y. Hiraoka, T. Ishikura, K. Okumura, Y. Kitagawa, H. Nakamura, Y. Wakabayashi, M. Soda, T. Asaka, and Y. Tanaka.

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[2]Y. Kitagawa *et al.*, Nature Mater. 9, 797 (2010).
[3]K. Okumura *et al.*, Appl. Phys. Lett. 98, 212504 (2011).