Keynote Lecture

KN01

Current Progress of Research on Magnetically-induced Ferroelectrics

T. Kimura[1]

[1]*Osaka University, Graduate School of Engineering Science, Osaka, Japan*

Among several different types of magnetoelectric multiferroics, “magnetically-induced ferroelectrics” in which ferroelectricity is induced by complex spin orders, such as spiral orders, exhibit giant direct magnetoelectric effects, i.e., remarkable changes in electric polarization in response to a magnetic field. Not a few spin-driven ferroelectrics showing the magnetoelectric effects have been found in the past decade.[1] However, their induced ferroelectric polarization is much smaller than that in conventional ferroelectrics and mostly develops only at temperatures much lower than room temperature. Thus, the quest for spin-driven ferroelectrics with room temperature operation and/or robust ferroelectric polarization is still a major challenge in magnetoelectric multiferroics research. In this presentation, I will begin with introducing the background of research on magnetically-induced ferroelectrics, and present the following current progress. Recently, some hexaferrites have been found to show direct magnetoelectric effects at room temperature and relatively low magnetic fields.[2] Furthermore these hexferrites show inverse magnetoelectric effects, that is, induction of magnetization by applying electric fields, at room temperature. The results represented an important step toward practical applications using the magnetoelectric effect in spin-driven ferroelectrics. This presentation introduces magnetism and magnetoelectricity of several types of hexaferrites which show magnetoelectric effect at temperatures above room temperature. In addition, I will also introduce our recent work on magnetoelectric perovskite manganites with large magnetically-induced ferroelectric polarization which is comparable to that in conventional ferroelectrics. This work has been done in collaboration with T. Aoyam, K. Haruki, K. Okumura, A. Miyake, K. Shimizu, and S. Hirose.

[1] *T. Kimura, Annu. Rev. Condens. Matter Phys. 3, 93 (2012).,* ***[2]*** *e.g., Y. Kitagawa et al., Nature Mater. 9, 797 (2010).*

Keywords: Multiferroics, Magetically-induced ferroelectrics, Magnetoelectric effect