

## Correlation between magnetic and dielectric properties

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### 【Outline of survey】

A magnetic field can be generated by the flow of an electrical current, which means intimate connection between an electric current and a magnetic field. In certain insulating materials, however, their magnetic properties can be changed by applying an electric field (not electric current). Such an unconventional coupling between magnetic and dielectric properties is termed *magnetoelectric* effect. The magnetoelectric effect defined as the generation of magnetization (electric polarization) by an electric (magnetic) field, has recently generated renewed attention since the effect can provide novel device design. In this research project, we investigate the following topics,

1. Development of materials with strong magnetoelectric coupling
2. Seeking novel magnetoelectric phenomena
3. Understanding of observed magnetoelectric phenomena
4. Proposal of novel measurements to study magnetism and/or dielectricity using magnetoelectric coupling.

Our goal is to construct a systematic research field concerning correlation between magnetism and dielectric property in solids.

### 【Expected results】

There have been no applications using magnetoelectric couplings developed to date, due mainly to materials limitations and the small magnitude of the effect. The success of the research project will be judged by the development of novel magnetoelectric materials and phenomena. The results will provide an important clue to device design for novel magnetoelectric memory elements or sensors.

### 【References by the principal investigator】

- “Cupric oxide as induced-multiferroic with high- $T_C$ ”, T. Kimura, Y. Sekio, H. Nakamura, T. Siegrist, A. P. Ramirez, *Nature Mater.* **7**, 291-294 (2008).
- “Spiral magnets as magnetoelectrics”, T. Kimura, *Annu. Rev. Mater. Res.* **37**, 387-413 (2007).

【Term of project】 FY2008—2012

### 【Budget allocation】

57,200,000 yen (direct cost)

### 【Homepage address】

<http://www.crystal.mp.es.osaka-u.ac.jp/>