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Dielectric and magnetic properties of metals doped BiFeO₃ nanoparticles

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Amongst the multiferroic ceramics being widely investigated, BiFeO₃ is a promising candidate for novel applications. BiFeO₃, having a rhombohedrally distorted perovskite ABO₃ (A=Bi, B=Fe) structure, possesses simultaneously ferroelectricity, ferromagnetism or ferroelasticity in a single phase. However, spiral modulated spin structure of BiFeO₃ prevents the observation of the linear magnetoelectric effect. In addition, the bulk BiFeO₃ is characterized by serious current leakage problems due to the existence of a large number of charge centers caused by oxygen ion vacancies. These problems limit the use of BiFeO₃ for fabrication of multifunctional devices. To overcome these problems, many attempts have been undertaken among which partial substitution of Bi³⁺ with ions having bigger ionic radius has been found to be effective to suppress the spiral spin structure of BiFeO₃. Here, the author investigated the co-doping effect of Ti, Gd and Ba to BiFeO₃ on the dielectric and magnetic properties of BiFeO₃. Nanoparticles of co-doped BiFeO₃ ceramics, which nominal compositions are Bi_{0.9}Gd_{0.1}Fe_{1-x}Ti_xO₃ and Bi_{0.7}Ba_{0.3}Fe_{1-x}Ti_xO₃ (x=0.00-0.25) were prepared by a simple method. XRD analysis revealed that the substitution of Fe by Ti induces a phase transition from rhombohedral to orthorhombic. Due to Ti substitution, the dielectric constant was stable over a wide range of high frequencies by suppressing the dispersion at low frequencies. Magnetic properties of Bi_{0.9}Gd_{0.1}Fe_{1-x}Ti_xO₃ and Bi_{0.7}Ba_{0.3}Fe_{1-x}Ti_xO₃ ceramics were considerably improved due to Ti substitution as well as size reduction. Details of the work will be presented at the conference.

Biography

Bashir Ahmmad has completed his PhD at the age of 31 from Kagoshima University, Japan. He is a recipient of Japanese Government Scholarship and also JSPS Postdoctoral fellowship by the Japan Society for the Promotion of Science. Currently, he is an Assistant Professor at the Graduate School of Science and Engineering, Yamagata University. His research interests include magnetic nanomaterials, nanophotocatalysts for solar hydrogen via water splitting and solar cells. He has published more than 40 papers in reputed journals and he is serving as editorial board member of International Institute of Engineers and guest editor of the *International Journal of Photoenergy*.

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