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Large coercive field and high-frequency millimeter wave absorption in metal-substituted ε-iron oxide nanomagnet

Epsilon iron oxide (ε-Fe_2O_3) is one of polymorphs of Fe_2O_3, which generates as a stable phase in nanometer size region. Our research group has reported the first synthesis of pure ε-Fe_2O_3 by using a chemical nanoparticle synthesis method. ε-Fe_2O_3 has a strong magnetic anisotropy, and thus exhibits a large magnetic coercive field of 25 kOe at room temperature, which is the largest value among magnetic metal oxides. In this presentation, we report the synthesis of metal subsutituted ε-Fe_2O_3 (ε-$M_xFe_2{-}xO_3$), crystallographic orientation of ε-$M_xFe_2{-}xO_3$ nanoparticles, and metal substitution effect on the magnetic properties. Especially, rhodium subsutitution enlarges the magnetic coercive field up to 35 kOe. Due to the large magnetic anisotropy, ε-Fe_2O_3 and ε-$M_xFe_2{-}xO_3$ show the electromagnetic wave absorption in a millimeter wave region of 35–222 GHz, which is the highest frequency electromagnetic wave absorption caused by the zero-field ferromagnetic resonance (natural resonance). The present materials are to be useful for recently developed millimeter wave technology such as car radar and high-speed wireless communication.

Speaker Biography

Asuka Namai is currently an Assistant Professor of Department of Chemistry, School of Science at The University of Tokyo. She received her Ph.D in Science at the University of Tokyo, Japan, in 2013. Her research focuses on the development and physical and chemical characterization of functionalized nanomaterials, with particular interest in iron oxide-based nanomagnets and magnetism.

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