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Soft Magnetic Nanocomposites Assembled by Fe/Al_2O_3 Core-Shell Nanoparticles with Tunable High-Frequency Property[1] Q. YAO, J.A. SUNDARARAJAN, Department of Physics, University of Idaho, Moscow, ID 83844, USA, D.T. ZHANG, Department of Physics, University of Idaho, Moscow, ID 83844, USA and Beijing University of Technology, China, H. HAN, D. MEYER, Y. QIANG, Department of Physics, University of Idaho, Moscow, ID 83844, USA — High-frequency soft magnetic films synthesized at room temperature (RT) are significant to the growing demand for improvement of next-generation microelectronic devices. For working in the gigahertz range, it is a challenge to develop uniaxial anisotropic films with high saturation magnetization, small coercivity and large resistivity. Accordingly, new Fe/Al_2O_3 core-shell cluster-assembled nanocomposites are created by employing novel energetic cluster impact. By applying potentials up to 20 kV to tilted Si substrates, in-plane uniaxial anisotropy is induced and tailored at RT, which is interpreted by the uniaxial shape anisotropy of the ellipsoidal nanoparticles and the alignment of the nanoparticle assembly. Moreover, the Fe/Al_2O_3 core-shell ratio is adjusted to control the excellent magnetic softness and ultra-high resistivity. Consequently, the Si-integration compatible nanocomposite films demonstrate tunable magnetic dynamic properties up to 8.5 GHz, measured by a shorted transmission-line perturbation method.

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