

Microwave Transmission through Metamaterial Based on Permalloy Flakes under Magnetic Resonance and Antiresonance Conditions

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Abstract : Transmission of electromagnetic waves through a plate of metamaterial based on permalloy flakes and reflection from the plate is investigated. The metamaterial is prepared of permalloy flakes sized from few to 50 μ placed into epoxy-amine matrix. Two series of metamaterial samples are under study with the volume portion of permalloy particles 15% and 30%. There is no direct electrical contact between permalloy particles. Microwave measurements have been carried out at frequencies of 12 to 30 GHz in magnetic fields up to 12 kOe. Sharp decrease of transmitted wave is observed under ferromagnetic resonance condition caused by absorption. Under magnetic antiresonance condition, in opposite, maximum of reflection coefficient is observed at frequencies exceeding 30 GHz. For example, for metamaterial sample with the volume portion of permalloy of 30%, the variation of reflection coefficient in magnetic field reaches 300%. These high variations are of interest to develop magnetic field driven microwave devices. Magnetic field variations of refractive index are also estimated.

Keywords : ferromagnetic resonance, magnetic antiresonance, microwave metamaterials, permalloy flakes, transmission and reflection coefficients

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