Nonlinear ferromagnetic resonance in micron and sub-micron amorphous wires

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Ferromagnetic resonance of glass-coated amorphous microwires FeSiB and CoFeSiB with the diameters varying from 133 nm to 25 μm and the glass thickness about 10 μm was measured at frequency of 9.5 GHz. Electric polarization of the wire can substantially amplify the microwave magnetic field on the sample surface. This allows us to achieve the threshold fields for nonlinear behavior with microwave power of only few mW. Above some critical value of incident power a distortion of central part of FMR curves is observed on FeSiB wires. For diameters less than 1.5 μm a series of sharp, nearly equidistant, peaks appears with the period δH inversely proportional to the wire diameter. The phenomenon is explained by the parametric excitation of dipole-exchange modes via the first order Suhl's spin-wave instability and the spin-wave confinement in very thin wires. In the CoFeSiB wires the nonlinear phenomena cannot be achieved even with the maximum power available (about 20 mW). It is probably because the threshold field is higher due to larger Gilbert damping constant and lower saturation magnetization of this alloy.