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Measurement of the intrinsic damping constant in individual nanodisks of Y3Fe5O12 and Y3Fe5O 12|Pt

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Abstract

We report on an experimental study on the spin-waves relaxation rate in two series of nanodisks of diameter / = 300, 500, and 700 nm, patterned out of two systems: a 20 nm thick yttrium iron garnet (YIG) film grown by pulsed laser deposition either bare or covered by 13nm of Pt. Using a magnetic resonance force microscope, we measure precisely the ferromagnetic resonance linewidth of each individual YIG and YIG Pt nanodisks. We find that the linewidth in the nanostructure is sensibly smaller than the one measured in the extended film. Analysis of the frequency dependence of the spectral linewidth indicates that the improvement is principally due to the suppression of the inhomogeneous part of the broadening due to geometrical confinement, suggesting that only the homogeneous broadening contributes to the linewidth of the nanostructure. For the bare YIG nano-disks, the broadening is associated to a damping constant α = 4 × 10-4. A threefold increase of the linewidth is observed for the series with Pt cap layer, attributed to the spin pumping effect. The measured enhancement allows to extract the spin mixing conductance found to be G = 1:55 × 1014 X-1 m-2 for our YIG(20nm) Pt interface, thus opening large opportunities for the design of YIG based nanostructures with optimized magnetic losses © 2014 AIP Publishing LLC.

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