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Full control of the spin-wave damping in a magnetic insulator using spin-orbit torque

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Abstract

© 2014 American Physical Society. It is demonstrated that the threshold current for damping compensation can be reached in a 5μm diameter YIG(20nm)|Pt(7nm) disk. The demonstration rests upon the measurement of the ferromagnetic resonance linewidth as a function of Idc using a magnetic resonance force microscope (MRFM). It is shown that the magnetic losses of spin-wave modes existing in the magnetic insulator can be reduced or enhanced by at least a factor of 5 depending on the polarity and intensity of an in-plane dc current Idc flowing through the adjacent normal metal with strong spin-orbit interaction. Complete compensation of the damping of the fundamental mode by spin-orbit torque is reached for a current density of ~3×1011A·m-2, in agreement with theoretical predictions. At this critical threshold the MRFM detects a small change of static magnetization, a behavior consistent with the onset of an auto-oscillation regime.

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