Plasmonic Nanoantenna For Energy-efficient All-Optical Switching

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Abstract

Our goal is to create plasmons to enhance All Optical Switching (AOS) of the magnetization. We used a finite-element model in order to understand the impact of plasmonic disk-shaped nanoantennas on magneto-optical effects. We first tested our model without an antenna and compare it with analytical solutions .The plasmonic nanoantenna tends to enhance the energy absorption in the layers, especially the magnetic layer, but also induces a field confinement around the antenna. These results sound promising for developing energy-efficient plasmonic magneto-optical devices.

Figures used in the abstract

Figure 1 : Fig 1 : Plasmonic systems. (a) Surface plasmon polaritons. (b) Localized surface plasmons.

Figure 2 : Fig 2 : AOS with GdFeCo. (a) HC vs. %Gd(atom.). (b) MOKE images of magnetization switching. (c) Magnetization switching mechanism.

Figure 3 : Fig 3 : Design. (a) σsc and σabs in air. (b),(c) σsc and σabs on substrate for different radius. (d) Power flow, time average (W/m²) in (x,y,0).

Figure 4 : Fig 4 : (a) Normalized fields in structure without disk (COMSOL vs. TMM method). (b) Mesh refinement (maximum mesh size in thin layers). (c) Absorption enhancement in GdFeCo.