Dielectric laser-field enhancement for magnetization switching in granular FePt recording media

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Granular FePt in the $L1_0$ phase is a key material for future magnetic data storage devices, supporting stable ferromagnetic order in grains of less than 10 nm in diameter. To switch the magnetization of magnetically hard materials like FePt, new writing techniques are needed such as Heat Assisted Magnetic Recording (HAMR). Here we investigate the nanoscale aspects of magnetization dynamics in granular FePt with fs X-ray pulses from the Linac Coherent Light Source at Stanford using resonant X-ray diffraction. We show that while many grains display fs laser-assisted magnetic switching in a magnetic field, some grains do not switch. We find that the ratio of spins that switch to spins that do not, differs between different samples due to morphology. However, the grains which do not follow the magnetic field show always less quenching (5-20%) than the grains which do follow (80-90%). Furthermore, we modeled the dielectric response of the FePt grains to the pump laser field, finding that the size, shape and proximity of grains to each other has significant influence on the absorption and determines if the grains will or will not follow the applied magnetic field.