Influence of the transition metal sublattice in $Gd_{23}(Fe_{1-x}Co_x)_{77}$ amorphous alloys for the laser induced magnetization reversal

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For about two decades, several research projects have demonstrated that it is possible to tune the magnetic order in Rare Earth-Transition Metal (RE-TM) amorphous alloys using a femtosecond laser radiation [1, 2)]. This novelty has excited the magnetic recording industry as it gives the possibility to write information at unprecedented speeds. Furthermore, the RE-TM amorphous alloys are ferrimagnetic and exhibit an out-of-plane magnetic anisotropy and their magneto-optical properties can be controlled during the fabrication process. However, if the obtainment of the magnetization reversal is now well established, its fundamental mechanisms are still not clear.

In this paper, we will focus on the influence of the TM sublattice during the magnetization reversal process. In particular we would like to address the importance of the exchange interaction in the GdFeCo amorphous alloys and how it influences the magnetization dynamics within these materials.

In order to do that, $Gd23(Fe_{1-x}Co_x)_{77}$ thin films, where the composition x was varied, have been fabricated by magnetron sputtering technique. Their magnetic properties have been investigated using SQUID-VSM, MOKE and pump probe techniques. The measurements showed that, when changing the TM composition while keeping the Gd composition fixed at 23 atomic percent, the properties of the sample are gradually modified. For instance, the variation of the compensation point in function of the TM composition is a direct signature of the relative changes between the RE and the TM magnetic moments therefrom the change of the exchange interaction between the two sublattices. As a consequence, the laser induced demagnetization has revealed a different demagnetization dynamics between the thin films (fig. 1) and a large difference of the oscillation frequency and the damping parameter during the recovery time as represented in the graph of figure 2. These findings, which will be developed during the talk, are important towards the understanding of the interaction between the two sublattices and the laser induced demagnetization in RE-TM alloys.

Reference

1) C. D. Stanciu et al., Phys. Rev. Lett. **99**, 047601 (2007).
2) T.A. Ostler et al., Nature comm. **3**, 666 (2012).

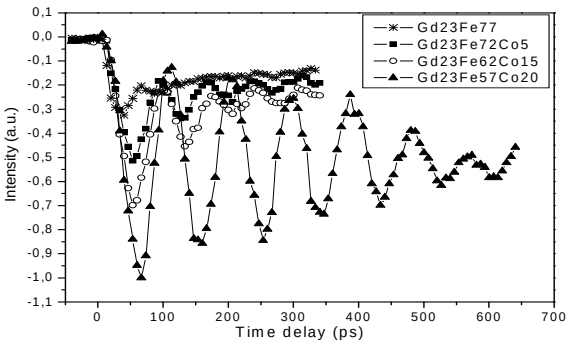

Fig.1. Magnetization dynamics after an ultrashort laser radiation in various GdFeCo thin films measured at RT under an external applied magnetic field of 280 mT.

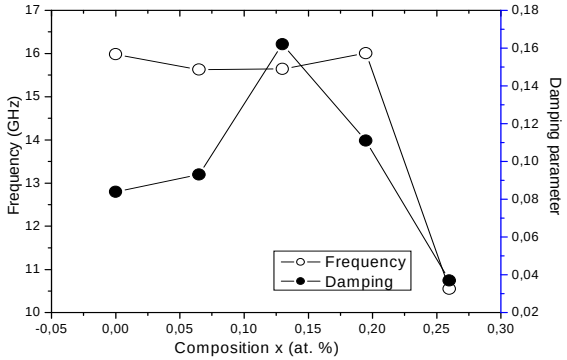

Fig.2 Gilbert damping parameter and oscillation frequency in $Gd_{23}(Fe_{1-x}Co_x)_{77}$ with the variation of x as deduced from RT pump-probe measurements.

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