第76回応用物理学会秋季学術講演会 講演予稿集 (2015 名古屋国際会議場)

Optical and magneto-optical properties of GdFe thin films in the photon energy range from 1.5 to 5.5 eV

Nagaoka Univ. of Tech. [1], Charles Univ. in Prague. [2], Japan Broadcasting Corporation (NHK) [3]

○Eva Jesenska[1,2], Takahiro Hashinaka[1], Lukas Beran[2], Jan Dusek[2], Martin Veis[2], Kiyoshi Kuga[3], Ken-ichi Aoshima[3], Kenji Machida[3], Hiroshi Kikuchi[3], Naoki Shimidzu[3] and Takayuki Ishibashi[1]

E-mail: jesenska@karlov.mff.cuni.cz

Considerable attention has been paid to magnetic and magneto-optical (MO) properties of GdFe thin films because this material provides significant advantages, such as large magnetization density, and possibility to adjust its compensation temperature, coercive and saturation magnetization by changing the composition [1,2]. Moreover, GdFe enables direct access to its spins through the electromagnetic interactions, which makes it subject of importance for future magnetic recording (such as heat assisted magnetic recording) and information processing technologies [3].

In this work, we present a systematic study of optical and MO properties of amorphous $Gd_{22}Fe_{78}$ thin films prepared by DC sputtering on thermally oxidized Si substrates. Thin SiN_x and Ru capping layers were used to prevent the $Gd_{22}Fe_{78}$ surface oxidation and contamination. Spectroscopic ellipsometry and MO Kerr effect spectroscopy (Fig.1) were employed as characterization techniques. A confrontation of ellipsometric and MO experimental data with advanced theoretical calculations provided a spectral dependence of complete permittivity tensor and a spectral dependence of the absorption coefficient in a wide spectral range. No significant changes in the permittivity tensors with different capping layers were observed, indicating a good material stability of $Gd_{22}Fe_{78}$ layer and validity of our characterization techniques.

This research was supported by the National Institute of Information and Communications Technology (NICT).

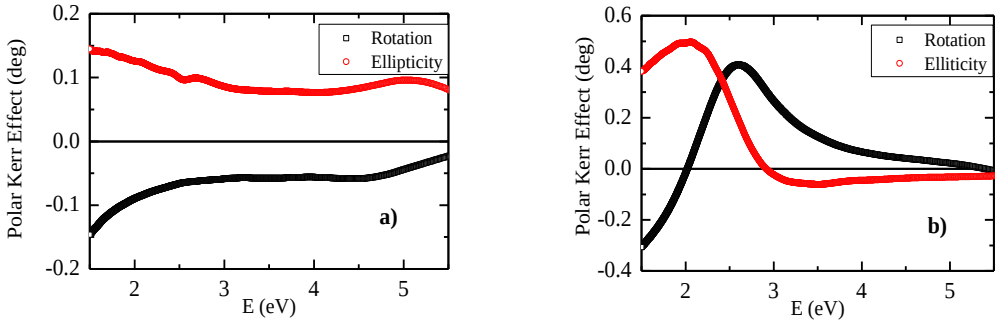

Fig. 1. Polar MO Kerr effect rotation and ellipticity spectra of $Gd_{22}Fe_{78}$ thin film with a) Ru coating and b) SiN_x coating. Black symbols correspond to Kerr rotation; red symbols correspond to Kerr ellipticity.

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