Photo magnetism in glasses doped with cobalt

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By doping glass, a non-magnetic material, with cobalt, a magnetic material, their individual properties combine, resulting in the emergence of new properties [1]. This study aims to investigate the magnetic and magneto-optical (MO) properties of cobalt thin films and cobalt-doped Soda Lime Glass (SLG). An in-situ simultaneous MO measurement and oxidation via laser irradiation of a cobalt thin film was performed.

Figure 1(a) illustrates the MO spectral behavior, showing a smooth increasing of the Faraday ellipticity for cobalt thin films, similar to the Drude dispersive model for metals [2]. Conversely, in the case of glass doped with cobalt, the spectrum exhibits two distinct bands. These bands correspond to the MO dipolar transitions of Co^{2+} ions in tetrahedral sites, which exist in the Co_3O_4 structure only[3]. Notably, the overall MO effect of cobalt, after its diffusion into the glass matrix, decreases tenfold, specifically at 1550 nm. To investigate the oxidation of a cobalt film, in-situ measurements were performed by simultaneously heating the cobalt thin film with a 1550 nm continuous wave laser, as depicted in Figure 1(b-c). The detected oxidized phase was confirmed to be Co_3O_4, as evidenced by the tenfold drop in measurements.

We are currently investigating the reversible transformation of Co_3O_4 to CoO in the glass doped with cobalt using the in-situ experiment presented in Figure 1 (b), exploring its potential for photomagnetic features in data storage and optical MO switching applications.

References

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Figures

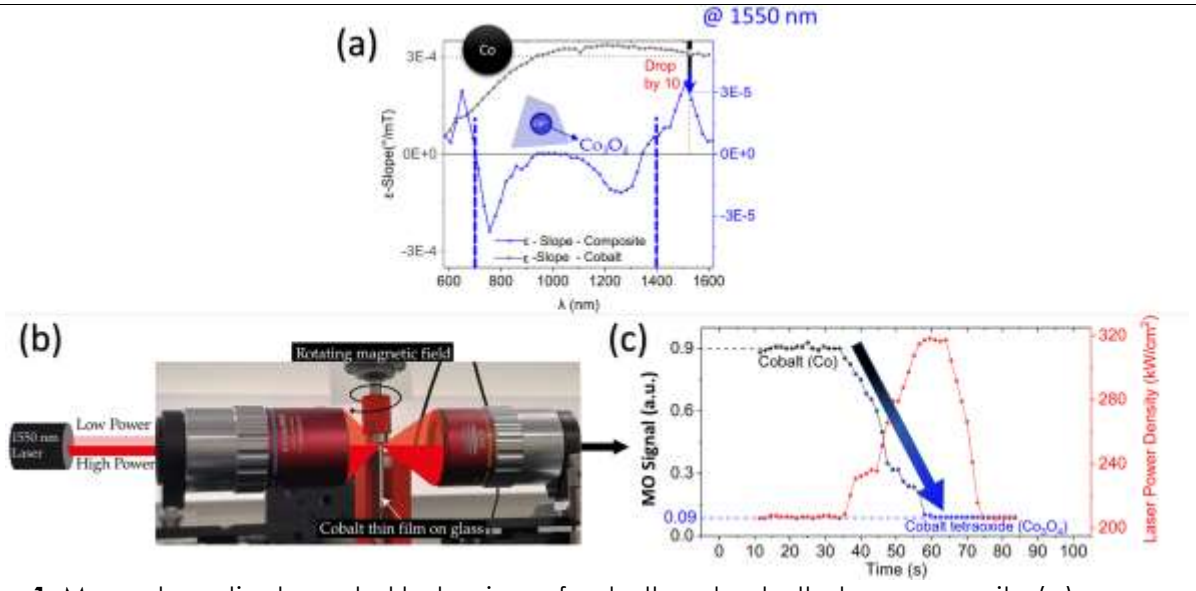

Figure 1: Magneto-optical spectral behaviour of cobalt and cobalt-glass composite (a). Simultaneous in-situ laser treatment (b) and magneto-optical oxidation measurement (c).