Magneto-optic (MO) materials are a new class of material that merges magnetics, optics, and plasmonics sub-fields of science. The main components of MO materials are ferromagnetic and ferromagnetic oxide materials such as Co, Fe, Ni, Magnetite, etc. where change in permittivity tensor is accompanied by the presence of magnetic spin or by applied external field. The permittivity tensor also depends on the frequency of the incident optical radiation.

Magneto-optic (MO) materials have application in wide-areas. These include determination of the average free carrier effective mass, detection of magnetic impurities; dynamic studies of film growth, MO filters as atomic line filter, memories, field sensors, modulators, and integrated optoelectronic devices, like optical circulators, isolators and switches. MO materials have also been used in drives using thermomagnetic recording and magnetic recording [3, 4]. Other fields include MO microscopy and spintronics. The most recent application of MO material is biosensing where effort is being made to develop world’s most sensitive biosensors.

Although the discovery of magneto-optic (MO) effects in metals and dielectric is not new (It was first demonstrated by Michael Faraday in 1945), its importance in magneto-optic based sensing and imaging has emerged only in the last few decades [1] [2] [3]. MO in spintronics and recording have been found application only beginning of 21st century [4]. One of the recent application of magnetic field on bio-sensing is demonstrated here [5] [6]. Figure shows a structure in Kretchmann configurations similarly to shown in our prior work [2]. It includes a right-angled isosceles prism, lenses, index matching liquid, buffer layer, a substrate with transducer/sample, and optical laser source and photo detection (PD) system. The direction of applied magnetic field, H is along the Co/Au interface [8]. The SPR of the MOSPR configuration having nano-scale layers of Co and Au in conjunction with 2 nm Ti adhesive layer shown on the bottom.
Figure on the top shows the differences between the SPR responses in air and water media. Sensitivity comparisons between gas and liquid media. As shown in the diagram. Both the SPR and MOSPR sensor responses in air medium is found to be stronger and is relevant for environmental and pollution studies. The sensor response in water medium is also found to be stronger compared to the sensor response of conventional SPR sensors, and is highly relevant for biosensing that involves liquid media.

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Keywords
Magnetooptics; SPR; MOSPR; Sensitive Biosensors; Plasmons

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