ABSTRACT

In-plane, out-of-plane, and angle-dependent magnetostriction were investigated at room temperature for polycrystalline $CoFe_2O_4$, $ZnFe_2O_4$, and ZnO film using the optical cantilever beam magnetometer set-up. $CoFe_2O_4$ film exhibits high compressive magnetostriction in in-plane and out-of-plane configurations. The non-180° domain wall movement together with domain rotation is the reason behind the origin of large magnetostriction. Moreover, a switching of compressive and tensile magnetostriction has been observed in the angle-dependent magnetostriction study of the $CoFe_2O_4$ film. For $ZnFe_2O_4$ film, we have found the tensile nature of magnetostriction in in-plane and out-of-plane geometries and a considerable enhancement in magnetostriction and strain sensitivity has been observed in out-of-plane geometry. In the angle-dependent magnetostriction study, the film shows the switching of compressive to tensile magnetostriction as the magnetic field is rotated in the plane of the film from 0° to 90°. A continuous rotation of magnetic domains has been proposed to demonstrate the result. For ZnO film, we have obtained a higher value of in-plane magnetostriction than the out-of-plane one. The reduction of magnetostriction value in out-of-plane configuration is attributed to the shape anisotropy of the film. In the case of angle-dependent magnetostriction study, the film is associated with both bipolar as well as unipolar nature of magnetostriction and also there is switching between the bipolar and unipolar magnetostriction as we rotate the in-plane magnetic field from 0° to 90°. In this dissertation, we have also investigated the electrostriction property of the fabricated polycrystalline ZnO film by the optical CBM set-up under the application of bipolar dc bias of ± 4 V. The film shows large values of piezoelectric strain and stress coefficients calculated from the deflection of the ZnO/Si composite. Large values of the piezoelectric strain and stress coefficients are attributed to the larger grain size and a higher degree of c-axis-oriented growth of the ZnO film. Finally, in this thesis, we have presented the investigation of electric field-controlled magnetization for polycrystalline ZnO film, $CoFe_2O_4$/ZnO heterostructure, and $ZnFe_2O_4$/ZnO heterostructure with the help of the indigenously developed optical CBM set-up. In all the cases, we have found the magnetization switching under the application of a localized electric field and this suggests the occurrence of converse magnetoelectric (CME) coupling between the electrical and magnetic order parameters. The maximum value of the CME coefficient is found to be 1.61×10^{-7} s/m, -1.44×10^{-6} s/m, and 1.69×10^{-7} s/m for ZnO film, $CoFe_2O_4$/ZnO heterostructure, and $ZnFe_2O_4$/ZnO heterostructure respectively.