

Development of $(\text{Bi}_{0.5}\text{L}_{0.5})(\text{Fe}_{0.7}\text{Co}_{0.3})\text{O}_3$ ($L=\text{La, Nd, Sm, Gd, Dy}$) Thin Films with Excellent Magnetic Properties for Magnetic Device Application

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$(\text{Bi}_{0.5}\text{L}_{0.5})(\text{Fe}_{0.7}\text{Co}_{0.3})\text{O}_3$ ($L=\text{La, Nd, Sm, Gd, Dy}$) thin films with ferromagnetism and ferroelectricity were fabricated using pulsed DC sputtering technique to obtain high saturation magnetization, perpendicular magnetic anisotropy and large magnetic Kerr effect. These magnetic properties are very important for realization of high performance magnetic devices driven by electric field. All $(\text{Bi}_{0.5}\text{L}_{0.5})(\text{Fe}_{0.7}\text{Co}_{0.3})\text{O}_3$ ($L=\text{La, Nd, Sm, Gd, Dy}$) thin films had relatively high saturation magnetization, perpendicular magnetic anisotropy and magnetic Kerr effect. Especially, $(\text{Bi}_{0.5}\text{Nd}_{0.5})(\text{Fe}_{0.7}\text{Co}_{0.3})\text{O}_3$ thin film had a very high saturation magnetization of 140 emu/cm^3 ($1.40 \times 10^5 \text{ A/m}$), a high perpendicular magnetic anisotropy of 2.6 at ratio of perpendicular coercivity against in-plane coercivity and $(\text{Bi}_{0.5}\text{La}_{0.5})(\text{Fe}_{0.7}\text{Co}_{0.3})\text{O}_3$ thin film had a very high magnetic Kerr rotation angle of 0.72° . These magnetic properties were excellent compared with the case of $(\text{Bi}_{0.5}\text{A}_{0.5})\text{FeO}_3$ ($A=\text{Ca, Sr, Ba}$) thin films with the maximum value of 90 emu/cm^3 ($9.0 \times 10^4 \text{ A/m}$) (for saturation magnetization), 0.8 (for ratio of Perpendicular coercivity against in-plane coercivity) and 0.03° (for magnetic Kerr rotation angle) which were fabricated previously. These magnetic properties are very important for realization of high performance magnetic devices driven by electric field.

Keywords : Multiferroic thin films, Magnetization, Magnetic anisotropy, Magnetic device