Study of magnetic and electrical properties of CoFe_2O_4 thin films

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In this study, we present the magnetic and electrical properties of CoFe_2O_4 thin films grown on quartz and Si substrates by Pulsed Laser Deposition (PLD). The films were characterized by X-ray diffraction (XRD), Atomic force microscopy (AFM) for structural analysis whereas Vibrating sample magnetometer (VSM) and two probe resistivity measurements were used for magnetization and dc resistivity measurement respectively.

Figure 1: XRD Pattern of CoFe_2O_4 thin films.

The structural analysis shows that different orientations and morphology were obtained. Figure 1 shows the XRD pattern of CoFe_2O_4 thin films. The surface morphology of CFO1 exhibits a rough surface while CFO2 and CFO3 have uniform microstructure. The magnetic hysteresis loops measured by VSM at room temperature both in-plane and out-of-plane configurations illustrate that the smooth and flat surface films possess perpendicular magnetic anisotropy (PMA) while the films with rough surface show weak PMA. Figure 2 depicts the hysteresis loops of CoFe_2O_4 thin films. Also the surface roughness of the thin films has profound effects on the electron transport properties.

The dc resistivity is higher for rough film as shown in figure 3.

Figure 2: Hysteresis loops of CoFe_2O_4 thin films

Figure 3: Variation of resistivity with temperature of CoFe_2O_4 thin films

References

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