Nuclear Instruments and Methods in Physics Research B: Beam Interactions with Materials and Atoms

Investigation of structural and magnetic properties of Co+ ion implanted indium tin oxide thin films on polyethylene terephthalate (C10H8O4)n substrates by 100 keV ions

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Abstract

Indium Tin Oxide (ITO) thin films have been used extensively in many applications, such as solar cells. In particular, ITO has been the material of choice in flat panel displays as one of its electrodes due to its low resistivity, high transmission of visible light and high free carrier density that contributes to its relatively low electrical resistivity. Modification of ITO thin films on polymer substrates using transition metal ion beams is rarely reported in literature. In this work, ITO thin film samples were implanted with Co^+ ions of energy 100 keV at fluences 1×10^{14}, 1×10^{15} and 1×10^{16} ions/cm^2. The grain sizes of the ITO thin films were observed to increase with increase in ion fluence, showing that the quality of the ITO thin films and crystallinity were getting enhanced. At a fluence of 1×10^{16} ions/cm^2, a high value of 2.33×10^{-3} emu/g magnetization was estimated. The level of residual magnetism in the Co^+ implanted thin films increased at an average of 35% with increase in ion fluence. This means that Co^+ implanted ITO thin films have good ability to retain a certain amount of residual magnetic field at zero magnetizing, as the ion fluence increases. Furthermore, the Co^+ ion implanted ITO thin films were found to exhibit clear room temperature ferromagnetism. The shift in hysteresis loops along applied magnetic field axes provides information about the exchange bias of Co^+ ion implanted ITO thin films in relation to grain size.