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Effect of 70 keV C ion implantation on the structural, morphological and magnetic properties of CeO_2 thin films

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Cerium dioxide has many applications due to its unique properties. It behaves like a conductor at high temperature and also important as oxygen storage and possess redox properties [1, 2]. Hence, it has applications in catalysis and solid oxide fuel cells. It has futuristic applications as chemical feedstock to produce ammonia, upgrading fossils fuels, reduction of CO_2 emission by direct production of hydrogen through photocatalytic water splitting. Apart from this, it has promising technological applications as buffer layers of superconducting materials and solid-oxide fuel cells.

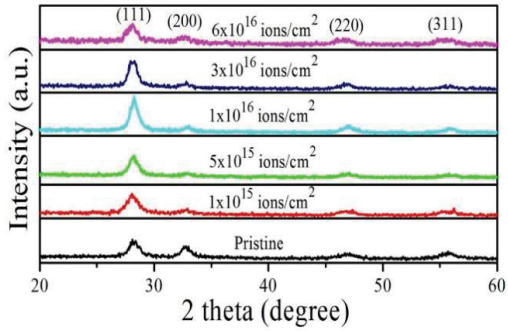

Figure 1: XRD patterns of Pristine and C-implanted CeO_2 thin films

Present work is focused on the investigation of structural, morphological and magnetic properties of 70 keV C ion implanted CeO_2 thin films. These thin films were deposited over the Si substrate using RF magnetron sputtering technique. The deposition was carried out in Ar gas environment at 150 W RF power for 1 hour. The various physical properties (the structural, morphological and magnetic properties) were investigated using versatile techniques such as X-ray diffraction (XRD), Raman spectroscopy, Rutherford back scattering (RBS), Atomic force microscopy (AFM), and vibrating sample magnetometer. XRD analysis confirms the cubic fluorite structure of CeO_2 thin films having Fm-3m space group as shown in Figure 1 [3]. The XRD patterns shows that intensity of (111) reflection plane increased with C ions fluence compared with pristine CeO_2 film.

Figure 2 shows the Raman spectra of pristine and C ions implanted CeO_2 films. It was observed that intensity of F_{2g} mode increased with C ions fluence however it is found to decreased for higher fluence ($6x10^{16}$ ions/cm^2) compared to pristine CeO_2 film. RBS measurement confirms the presence of carbon in CeO_2 films. Further, the morphological images from AFM and magnetic properties of C ions implanted CeO_2 films will be reported.

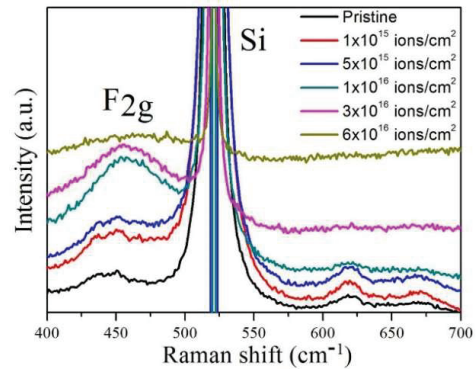

Figure 2: Raman spectra of Pristine and C-implanted CeO_2 thin films

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