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XAS Studies of Ion Irradaited MgO Thin Films

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Magnesium oxide has become focus for research activities due to its use in magnetic tunnel junctions and for understanding of do ferromagnetism. Theoretical investigations on such type of system indicate that the presence of defects greater than a threshold value is responsible for the magnetic behaviour. It has also been shown experimentally that by decreasing the film thickness and size of nanoparticles, enhancement/increase in magnetization can be achieved. Apart from the change in dimension, swift heavy ions (SHI) are well known for creating defects and modifying the properties of the materials. In the present work, we have studied the irradiation induced effects in magnesium oxide thin film deposited on quartz substrate via X-ray absorption spectroscopy (XAS). Magnesium oxide thin films of thickness 50nm were deposited on quartz substrate by using e-beam evaporation method. These films were irradiated by 200 MeV Ag15+ ion beam at fluence of 1×10^{11}, 5×10^{11}, 1×10^{12}, 3×10^{12} and 5×10^{12} ions/cm^2 at Nuclear Science Centre, IUAC, New Delhi (India). The grain size was observed (as studied by AFM) to be decreased from 37 nm (pristine film) to 23 nm (1×10^{12} ions/cm^2) and thereafter it increases upto a fluence of 5×10^{12} ions/cm^2. The electronic structure of the system has been investigated by X-ray absorption spectroscopy (XAS) measurements performed at the high energy spherical grating monochromator 20A1 XAS (HSGM) beamline in the National Synchrotron Radiation Research Center (NSRRC), Taiwan. Oxides of light elements like MgO/ZnO possess many unique physical properties with potentials for novel application in various fields. These irradiated thin films are also studied with different polarization (left and right circularly polarized) of incident x-ray beam at 05B3 EPU- Soft x-ray scattering beamline of NSRRC. The detailed analysis of observed results in the wake of existing theories is discussed.

Keywords: Ion Irradiation, MgO thin film, X-ray absorption spectroscopy