ABSTRACT

This work explores the structural, morphological, optical and electrical properties of molybdenum oxide (MoO_3) films prepared on different substrates by radiofrequency (RF) magnetron sputtering technique. The MoO_3 films were deposited on glass, Al, Mo and Si at room temperature by RF magnetron sputtering of pure Mo target in reactive oxygen environment. The as-deposited films were annealed in air at 400 °C and at 500 °C to improve their crystalline quality. X-ray diffraction results of as-deposited films did not reveal any diffraction peak due to amorphous nature of the films. However, the films annealed at 400 °C exhibited diffraction peaks corresponding to orthorhombic (α) and monoclinic (β) phases of MoO_3 with good crystalline quality. As the annealing temperature was increased to 500 °C, the α-phase of MoO_3 film on glass became more significant whereas the β-phase of MoO_3 was more dominant on Mo substrate as compared to the other substrates. The Fourier transform infrared (FTIR) spectroscopy showed stretching vibrational modes of Mo=O and transverse optical modes of Mo-O-Mo on all the substrates, endorsing α and β phases of MoO_3 respectively. The surface morphology of as-deposited MoO_3 films showed spherical shaped grains that were changed into different shapes by annealing the films at 400 °C and at 500 °C. These morphological changes were associated with tensile strain developed inside MoO_3 due to lattice and thermal mismatch between the film and the substrate. The band gap of MoO_3 film on different substrates was found to be in the range 3.16 eV to 4.0 eV. A decrease in band gap after annealing was observed which was attributed to reduction of defects inside the films. The electrical resistivity of MoO_3 was also slightly decreased after annealing the films at 400 °C and at 500 °C.