

EFFECT OF ALUMINIUM AND TIN OXIDE DOPING ON THE STRUCTURAL AND OPTICAL PROPERTIES OF PULSED LASER DEPOSITED NANOCRYSTALLINE TANTALUM OXIDE THIN FILMS

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ABSTRACT

Nanocrystalline SnO_2 and Al_2O_3 doped Ta_2O_5 thin films have been deposited on quartz substrates using reactive pulsed laser deposition. GIXRD studies indicate a phase transition from hexagonal δ - TaO to orthorhombic β - Ta_2O_5 for SnO_2 doped films around a substrate temperature of 773 K whereas the crystallization in the hexagonal δ - TaO phase for the Al_2O_3 doped films is found to be around 973 K. The preferred orientation is found to be sensitive to a substrate temperature for the SnO_2 doped films and is found to change from (0 0 1) to (110) crystal plane of the film deposited at a substrate temperature of 973 K. Micro Raman analysis of SnO_2 and Al_2O_3 doped films show a hardening and disappearance of certain modes which indicates a structural phase transition as confirmed from the GIXRD studies. Al_2O_3 doping gives rise to an additional mode around 150 cm^{-1} corresponding to O-Ta-O bending vibrations in TaO_6 octahedra, which is found to be absent in SnO_2 doped films. The transmittance of Ta_2O_5 films deposited at 300 K is found to decrease up on SnO_2 doping and increase up on Al_2O_3 doping compared with the undoped film and decreases with the increase in substrate temperature for both dopants.

KEYWORDS: Micro-Raman Spectra, Pulsed Laser Deposition, Tantalum Oxide, Texture Coefficient, X-Ray Diffraction