

POC019

The Systematics of Reactive Ion Beam Sputter Deposition of SiO₂ and TiO₂ Thin Films

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Ion beam sputter deposition (IBSD) is a physical vapour deposition (PVD) technique, which uses a low-energy ion beam for sputtering a target. In contrast to other PVD techniques, for instance, magnetron sputtering or evaporation techniques, IBSD offers more degrees of freedom for tailoring the properties of the secondary, film-forming particles and, hence, thin film properties [1].

This paper focuses on systematic investigations of the IBSD process of oxide thin films, namely, SiO₂ [2,3] and TiO₂ [4-6], using O₂ [3,6], Ar or Xe ions [2,4,5] with an ion energy between 0.5 keV and 2.0 keV. Additionally, the ion incidence angle and polar emission angle were systematically varied. The films were characterized with respect to crystal structure, composition, surface roughness, mass density and optical properties. Systematic correlations of between process parameters and thin film properties were found, which can be assigned to properties of sputtered target and scattered primary particles, especially, to the energy of these particles. The most crucial process parameters were identified to be the scattering angle and the ion species, or, to be more precise, the mass of the primary ions in relation to the mass of the target particles. The systematics are similar for SiO₂ and TiO₂ films. However, the variations in absolute numbers can differ considerably.

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Keywords

Ion beam sputter deposition, film properties, scattering geometry, SiO₂, TiO₂