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Growth of Tin Oxide Thin Films by a Hybrid Ion Beam

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Tin oxide films were deposited by using a Hybrid Ion Beam(HIB) source, which were composed of an ionized cluster beam and a broad gas ion beam. Reactive ionized cluster beam deposition(R-ICB) and ion assisted deposition(IAD) methods were adopted to grow tin oxide thin films in oxygen gas environment. In R-ICB, crystalline structures of deposited tin oxide films were found to be a mixture of Sn metal and tin mono-oxide(SnO), whereas those of tin oxide films fabricated by IAD were tin di-oxide(SnO₂). Composition and chemical states of tin di-oxide films with preferred orientation along <110> and <200> axis were identified by AES and XPS. Moreover, surface morphology of deposited tin oxide films at various conditions was examined by AFM. in which average root-mean-square of surface roughness, σ , was increased from 47 to 212 Å as acceleration voltage is raised from 0 to 4 kV, but instead that of SnO₂(200) film is measured by 10 Å. In growing process of metal oxide thin films using ion beam, the crystalline structure and surface roughness, etc. of deposited thin films are discussed in terms of mainly average ion beam energy.