[IV~22]

Change of Properties of Tin Oxide Film by average energy per Sn atom in Reactive Ion-Assist Deposition(R-IAD)

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Neutral tin atom is evaporated with assisting ionized oxygen gas in high vacuum condition at a pressure of 1 x 10^{-4} Torr and tin oxide film is deposited on Si and glass substrate at room temperature. Oxygen gas is ionized and accelerated by cold-hallow-cathode type ion gun at oxygen flow rate of 3 sccm(ml/in.). Average energy per Sn atom in the deposition process is changed by the amount of ionized oxygen which is varied by changing discharge potential in a range 400 to 450 eV.

Composition of as-deposited tin oxide films increased from 1.17 to 1.95 and atomic state of Sn in tin oxide films changed Sn^{2+} to Sn^{4+} with average energy per Sn atom. Surface roughness of as-deposited tin oxide films changed from 9 to 25 Å and optical transmittance increased to 90 % with average energy per Sn atom.

In order to investigate effect of initial composition on properties of annealed tin oxide films, the as-deposited tin oxide films were annealed at 400, 500 ℃ for 1 hr. The crystallinity and surface roughness of annealed tin oxide films showed strong dependence on the initial composition of as-deposited tin oxide films.