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Indium Tin Oxide Sputtering Damage to Catalytic Chemical Vapor Deposited Amorphous Silicon Passivation Films and Its Recovery

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Abstract

We investigated the influence of indium tin oxide (ITO) sputtering damage to various types of amorphous silicon (a-Si) passivation films deposited by catalytic chemical vapor deposition. Intrinsic (i-) a-Si, n-type (n-) a-Si/i-a-Si, and p-type (p-) a-Si/i-a-Si stacked films were prepared on crystalline Si, and ITO was sputtered at various temperatures and RF powers, followed by post-annealing at 200 °C. Effective minority carrier lifetime (τ_{eff}) of almost all the samples decreases drastically after sputtering, while τ_{eff} of the samples with ITO sputtered at room temperature recovers significantly by post-annealing. Annealing before sputtering and sputtering at lower RF power leads to more effective recovery of τ_{eff} . The samples with ITO sputtered to an n-a-Si/i-a-Si stack show large τ_{eff} recovery, while the samples with ITO sputtered to a p-a-Si/i-a-Si stack show much smaller τ_{eff} recovery. τ_{eff} recovery after ITO sputtering thus depends on the types of a-Si passivation films, which may be related to the modification of band alignment by the existence of ITO.

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