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Cluster control plasma CVD for fabrication of stable a-Si:H solar cells[1] MASAHARU SHIRATANI, YUUJI HASHIMOTO, YOSHINORI KANEMITSU, HYUNWOONG SEO, KUNIHIRO KAMATAKI, GIICHIRO UCHIDA, NAHO ITAGAKI, KAZUNORI KOGA, Kyushu University — Light-induced degradation of a-Si:H is the key issue for a-Si:H solar cells, because light exposure initially causes a significant reduction of the efficiency of the cells due to the degradation. In SiH4 discharges employed for a-Si:H deposition, there coexist three deposition precursors; SiH3 radicals, HOS radicals, and amorphous clusters (nanoparticles) [1]. SiH3 radicals are the main deposition precursors for "good" quality films, whereas clusters are the precursors to cause the light induced degradation. To suppress cluster incorporation into films, we employ, 1) magnetic field which modifies EEDF, 2) gas heating to suppress polymerization reactions in gas phase, 3) gas flow which drives clusters downstream, 4) thermophoretic force which supresses cluster deposition, and 5) a cluster eliminating filter. Our a-Si:H films deposited at 3 nm/s show a low stabilized defect density of 5x1015 cm-3. To evaluate their quality as an I layer of PIN solar cells, we have measured Fill Factor (FF) of N-type c-Si/a-Si:H/Ni Schottky cells of such cluster-free a-Si:H films. Our cell shows high initial FF of 0.516, high stable FF of 0.514, and little light induced degradation ratio of 0.39%.

[1] Y. Kim, et al., Jpn. J. App. Phys. 52 (2013) 01AD01.

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Masaharu Shiratani
Kyushu University

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