# Impact of hydrogen dilution on optical properties of intrinsic hydrogenated amorphous silicon films prepared by high density plasma chemical vapor deposition for solar cell applications

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## Abstract

P-i-n single-junction hydrogenated amorphous silicon (a-Si:H) thin film solar cells were successfully fabricated in this study on a glass substrate by high density plasma chemical vapor deposition (HDP-CVD) at low power of 50 W, low
temperature of 200°C and various hydrogen dilution ratios (R). The open circuit voltage (Voc), short circuit current density (Jsc), fill factor (FF) and conversion efficiency ($\eta$) of the solar cell as well as the refractive index (n) and absorption
coefficient ($\alpha$) of the i-layer at 600 nm wavelength rise with increasing R until an abrupt drop at high hydrogen dilution, i.e. $R > 0.95$. However, the optical energy bandgap (Eg) of the i-layer decreases with the R increase. Voc and $\alpha$ are inversely correlated with Eg. The hydrogen content affects the i-layer and p/i interface quality of the a-Si:H thin film solar cell
with an optimal value of $R = 0.95$, which corresponds to solar cell conversion efficiency of 3.85%. The proposed a-Si:H thin film solar cell is expected to be improved in performance.

Keyword：high density plasma chemical vapor deposition; hydrogenated amorphous silicon; thin film solar cell;