
Characteristic analysis of optimized SiO₂ / SiON_x stack passivation layer and Study on application of high efficiency N-type c-Si solar cell

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High quality surface passivation is an essential element for high efficiency of n-type crystalline silicon (c-Si) solar cell. The passivation layer can reduce the dangling bond that causes carrier recombination from the surface, which contributes to increase in carrier lifetime. Generally, SiO₂, SiN_x, Al₂O₃ are used for the passivation layer, but in this study, SiON layer which can be applied to ARC (anti-reflection coating) is optimized by PECVD (plasma enhanced chemical vapor deposition) We conducted experiments. In order to confirm the optimized SiON layer, deposition was carried out by varying the SiH₄ / NH₃ / N₂O gas ratio at a substrate temperature of 300°C. For each condition, SiON shows Neutral charge compared to SiN_x through CV analysis, it has better passivation characteristics, satisfying charge effect and surface passivation at the same time. In addition, SiN_x has a value of 10.23%/ 80.36% in reflectance and transmittance measurements, while SiON confirmed an increase in IQE due to a short wavelength using a result of 5.8%/ 88.6%. An optimum passivation condition was established with SiH₄ 45sccm / NH₃ 25sccm / N₂O 45sccm. In this condition, after deposition on p type and n type bare wafer, The FGA(Foaming gas annealing) was performed at 470 ° C for 15 minutes in H₂ (15% H₂ / Ar) atmosphere to measure lifetime and implied Voc. After that, after the heat treatment (Firing) process, lifetime and iVoc were re-measured to establish conditions applicable to the passivation layer. Using this established SiON optimum condition, it can be applied to highly efficient n-type c-Si solar cell.