

IBC형 태양전지 제작을 위한 p-a-Si:H 증착층의 파이버 레이저 가공에 관한 연구

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Study on Fiber Laser Annealing of p-a-Si:H Deposition Layer for the Fabrication of Interdigitated Back Contact Solar Cells

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Abstract : Using multi plasma enhanced chemical vapor deposition system (Multi-PECVD), p-a-Si:H deposition layer as a p^+ region which was annealed by laser (Q-switched fiber laser, $\lambda = 1064$ nm) on an n-type single crystalline Si (100) plane circle wafer was prepared as new doping method for single crystalline interdigitated back contact (IBC) solar cells. As lots of earlier studies implemented, most cases dealt with the excimer (excited dimer) laserannealing or crystallization of boron with the ultraviolet wavelength range and 10^{-9} sec pulse duration. In this study, the Q-switched fiber laser which has higher power, longer wavelength of infrared range ($\lambda = 1064$ nm) and longer pulse duration of 10^{-8} sec than excimer laser was introduced for uniformly deposited p-a-Si:H layer to be annealed and to make sheet resistance expectable as an important process for IBC solar cell p^+ layer on a polished n-type Si circle wafer. A 525 μm thick n-type Si semiconductor circle wafer of (100) plane which was dipped in a buffered hydrofluoric acid solution for 30 seconds was mounted on the Multi-PECVD system for p-a-Si:H deposition layer with the ratio of $\text{SiH}_4:\text{H}_2:\text{B}_2\text{H}_6 = 30:120:30$, at 200 $^\circ\text{C}$, 50 W power, 0.2 Torr pressure for 20 minutes. 15 mm \times 15 mm size laser cut samples were annealed by fiber laser with different sets of power levels and frequencies. By comparing the results of lifetime measurement and sheet resistance relation, the laser condition set of 50 mm/s of mark speed, 160 kHz of period, 21 % of power level with continuous wave mode of scanner lens showed the features of small difference of lifetime and lowering sheet resistance than before the fiber laser treatment with not much surface damages. Diode level device was made to confirm these experimental results by measuring C-V, I-V characteristics. Uniform and expectable boron doped layer can play an important role to predict the efficiency during the fabricating process of IBC solar cells.

Key Words : Multi-PECVD, Fiber laser annealing, Lifetime, Sheet resistance