Reducing surface recombination is a critical factor for high efficiency silicon solar cells. The passivation process is for reducing dangling bonds which are carrier. Tunnel oxide layer is one of main issues to achieve a good passivation between silicon wafer and emitter layer. Many research use wet-chemical oxidation or thermally grown which the highest conversion efficiencies have been reported so far. In this study, we deposit ultra-thin tunnel oxide layer by PECVD (Plasma Enhanced Chemical Vapor Deposition) using N₂O plasma. Both side deposit tunnel oxide layer in different RF-power and phosphorus doped a-Si:H layer. After deposit, samples are annealed at 850°C for 1 hour in N₂ gas atmosphere. After annealing, samples are measured lifetime and implied Voc (iVoc) by QSSPC (Quasi-Steady-State Photo Conductance). After measure, samples are annealed at 400°C for 30 minute in Ar/H₂ gas atmosphere and then measure again lifetime and implied VOC. The lifetime is increase after all process also implied VOC. The highest results are lifetime 762 μs, implied Voc 733 mV at RF-power 200 W. The results of C-V measurement shows that Dit is increase when RF-power increase. Using this optimized tunnel oxide layer is attributed to increase iVoc. As a consequence, the cell efficiency is increased such as tunnel mechanism based solar cell application.

Keywords: Tunnel oxide, passivation, PECVD, Implied Voc

Figure 1. Sample structure
Figure 2. The results of C-V measurement as various RF-power

Figure 3. $D_{it}$ characteristic as various RF-power