Solution-processed Back-contact PEDOT:PSS/c-Si Heterojunction Solar Cells

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Introduction : We demonstrated highly efficient conductive polymer PEDOT:PSS/c-Si heterojunction solar cells with an efficiency of 13-15% using spin-coated PEDOT:PSS on top of flat N-type Si(100) substrate. Also, we demonstrated the PV performance of solar cell module with 2 cm^2 and 4 inch wafers (in this meeting). In this study, we present a solution-processed PEDOT:PSS/c-Si heterojunction solar cell with a back contact structure(Fig. 1) to improve the stability of the device performance and to suppress the incident optical loss of front side.

Experiment: N-type CZ c-Si wafers (1-5 Ω·cm, 150 μm thickness) were used as a substrate. They were cleaned by organic solvents followed by HF etching (5%, 2 min) to remove native oxide. Then, the substrates were treated by a conventional Topcon approach use 10wt% HNO_3 to reform SiO_x layers. Commercialized PEDOT:PSS (Clevios PH1000) using EG(7wt%) and Zonyl(0.2wt%) as dopants was spin coated at 2000 rpm for 30s followed by thermal annealing at 140˚C for 20 min. Subsequently, 2wt% Nafion solutions in IPA were spin coated at 2000 rpm for 1min on front of the rear sides as a passivation layer, followed by annealing at 100°C for 10 min. After that, Ag and InGa fingers were yielded as intergraded structures on top of PEDOT:PSS and bared Si area where the PEDOT:PSS were been removed, respectively. The back-contact PEDOT:PSS/c-Si solar cells were characterized using life time measurement, I-V, EQE, and 2D mapping of solar cell parameters

Conclusion: Figure 1 shows the I-V curves of back-PEDOT:PSS junction solar cells on plane c-Si wafer with different ell performance was been dramatically improved to 10.6% with a J_{sc} of 29mA/cm^2, a V_{oc} of 0.61V and an *FF* of 0.61 due to well passivated interface by Topcon treatment and Nafion deposition, although efficiency is still lower than convention front PEDOT:PSS/c-Si solar cell due to higher contact resistance of solution-processed integrated electrode and insufficient passivation of Si surface at anode/cathode gap. We will discuss the potential of back-contact PEDOT/c-Si device.

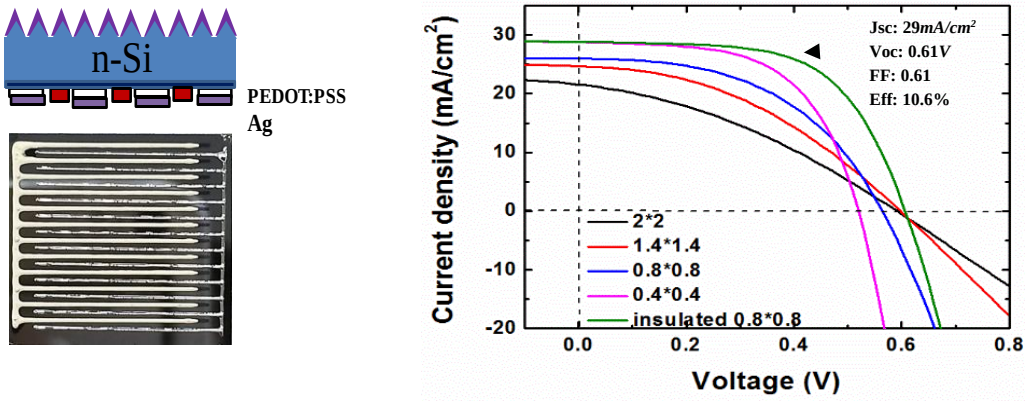

Figure 1. (Left) Schematic and photo of back-contact PEDOT:PSS/c-Si cell. Device size is 2×2cm^2. (Right) J-V curves of back-contact devices with different active areas defined by metal masks.

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