

Films of single-walled carbon nanotubes as stable and efficient electron-blocking layers and transparent electrodes for solar cells.

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It was found that a film of single-walled carbon nanotubes (SWNTs) can be a dual-functional layer as electron-blocking-layer and transparent electrode through studies of nanotube-silicon heterojunction solar cells [1,2]. This dual functionality is demonstrated for organic and perovskite solar cells. We have demonstrated efficient SWNT/Si solar cells using dry-deposited high-quality SWNTs [1] and honeycomb-structured SWNTs [2]. The SWNT/Si solar cells using the dry deposited SWNT film demonstrated the air-stable power conversion efficiency (PCE) of 11.6 % before any intentional doping process. For organic solar cells, the SWNT/MoO_x/PEDOT:PSS layer was demonstrated as a dual functional layer replacing ITO and organic electron-blocking-layer. Using PTB7/PC₇₁BM mixture as active materials, the PCE of 6 % was obtained for glass substrate and 3.9 % on flexible PET substrate [3]. This dual-functional layer was also demonstrated in double-sided illumination perovskite solar cells using SWNT film instead of electron-blocking-layer and gold electrode with over 9 % PCE. Another perovskite solar cell structure using SWNTs instead of ITO is also proposed [4].

A part of this work was financially supported by Grants-in-Aid for Scientific Research (25107002, 15H05760) and IRENA Project by JST-EC DG RTD, Strategic International Collaborative Research Program, SICORP.

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