

Carbon nanotube films for perovskite solar cells with higher stability

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A film of single-walled carbon nanotubes (SWNTs) can be flexible and stretchable transparent-conductive layer. At the same time, this film can be carrier-selective layers, i.e., electron-blocking-layers or hole-blocking-layers, by using adequate doping. Based on our experiences of using nanotube films for CNT-Si solar cells and organic polymer solar cells, we will extend the application of CNT films for organic-inorganic Perovskite solar cells. We have demonstrated the replacement of ITO in inverted-type perovskite solar cells, SWNTs/PEDOT:PSS/CH₃NH₃PbI₃/PCBM/Al [1]. The flexible application on polyethylene terephthalate (PET) is also demonstrated [1]. Replacement of electron-blocking-layer and metal electrode in normal-type perovskite solar cells is demonstrated as well. They show high power conversion efficiency (PCE), cost-efficiency, and higher stability. Those devices can have comparable PCE as the conventional design with organic electron-blocking layer and top metal electrode. The normal-type perovskite solar cell, composed of ITO/C₆₀/CH₃NH₃PbI₃/SWNTs, can achieve a PCE of 17 % with spiro-MeOTAD as dopant to SWNTs [2]. This structure with a perovskite layer sandwiched by C₆₀ and SWNTs can lead to the solar cells without hysteresis and with much improved air-stability [2]. The effective passivation of the degradation of perovskite material by moisture can be achieved with C₆₀ and SWNTs [2]. More recent configuration is using a film of SWNTs for both anode and cathode electrode. With adequate doping, we can fabricate Perovskite solar cells without ITO and metal electrode.

This work was supported by JSPS KAKENHI Grant Numbers JP25107002, JP15H05760, and IRENA Project by JST-EC DG RTD, Strategic International Collaborative Research Program, SICORP. Part of this work is based on results obtained from a project commissioned by the New Energy and Industrial Technology Development Organization (NEDO).

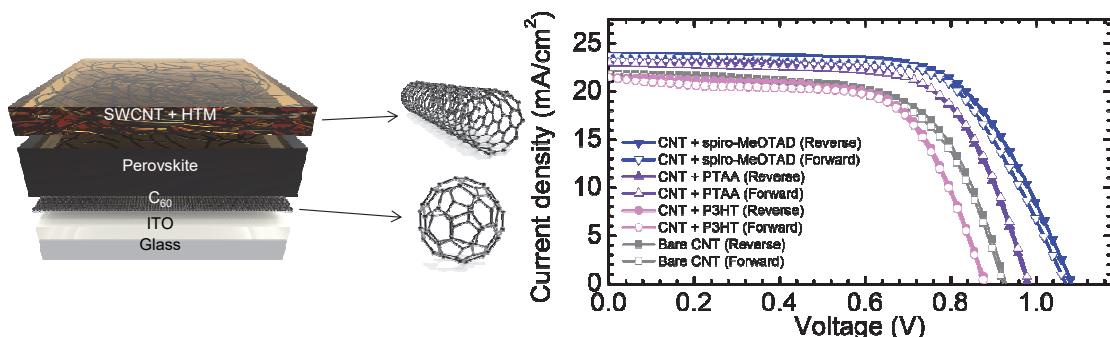


Fig. 1: Perovskite solar cell with carbon nanotube and C₆₀ film as carrier selective layers [2].

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[2] N. Ahn, I. Jeon, J. Yoon, E. I. Kauppinen, Y. Matsuo, S. Maruyama, M. Choi, to be submitted.