Carbon nanotube film for next generation solar cells

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A film of single-walled carbon nanotubes (SWNTs) can be a dual-functional layer as electron-blocking-layer and transparent electrode in various solar cells. We have demonstrated efficient SWNT/Si solar cells using dry-deposited high-quality SWNTs and honeycomb-structured SWNTs [1-3]. The dual functionality is also demonstrated for organic and perovskite solar cells. For organic solar cells, the SWNT/MoOx/PEDOT:PSS layer was demonstrated as a dual functional layer replacing ITO and organic electron-blocking-layer. The power conversion effciency (PCE) is comparable to those this using ITO. As the advantage of the film of SWNTs, the flexible organic solar cells can be easily demonstrated [4]. Similar replacement of ITO was demonstrate for Perovskite type solar cells [5]. In addition to the replacement of ITO, it is also possible to replace electron-blocking-layer and metal electrode for both inverted-type organic [6] and normal-type Perovskite solar cells [7]. Those devices with comparable PCE can be semi-transparent and can be illuminated from both sides. The chemical stabily of a film of SWNTs compared with polymer electron-blocking-layer is the further advantage of those systems. Especially for Perovskite solar cells, a film of SWNTs and C60 can significantly enhance the stability of Perovskite layer. The stable and highly efficient, say 15 % PCE, Pervskite solar cells using a film of SWNTs and C60 are demonstrated.

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