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有機金属ペロブスカイトへの NPD：MoO_3 を正孔輸送材料の応用

Study on Hole Transport Layer of NPD:MoO_3 for Organometal Perovskite Solar cells

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Introduction: Organometal halide perovskite solar cells have recently gained a lot of attention due to their high Power Conversion Efficiency (PCE). It was reported that high and efficient organometal halide perovskite solar cells with the structure of FTO glass/compact TiO_2/mesoporous-TiO_2 or Al_2O_3 scaffold/$CH_3NH_3PbI_3$/spiro-OMeTAD/Au have reached a PCE of 15% [3]. The desire for more efficient and low cost perovskite solar cells compelled us to investigate the effect of co-evaporation of NPD:MoO_3 as an alternative hole transport material (HTM) for $CH_3NH_3PbI_3$ perovskite solar cells, since the conventional spiro-OMeTAD is quite expensive. For our most efficient perovskite solar cells we achieved a PCE of 4.20% with Jsc 15.2mA/cm^2, Voc 0.62V and FF 0.44 for a structure of FTO glass/compact TiO_2/mesoporous-TiO_2/ CH_3NH_3PbI /NPD:MoO_3/ 80nm thick Au.

Results and Discussion

We investigated the effects of with and without co-evaporation of NPD:MoO_3 as HTM in Perovskite solar cells. Fig. 1 represents the J-V curves for $CH_3NH_3PbI_3$/w NPD:MoO_3 and $CH_3NH_3PbI_3$/w/o NPD:MoO_3. The cells without NPD:MoO_3 shows a better PV properties in contrast to $CH_3NH_3PbI_3$/w NPD:MoO_3 while cells with NPD:MoO_3 shows a higher FF. Fig. 2 is the IPCE curves for with and without NPD:MoO_3 perovskite solar cells. Both specimens with or without NPD:MoO_3 show a similar IPCE. Fig. 3 is the UV-vis absorbance spectra of $CH_3NH_3PbI_3$/w NPD:MoO_3 and $CH_3NH_3PbI_3$/w/o NPD:MoO_3. In contrast, the cells without NPD:MoO_3 shows a better response in the visible region than the cells with NPD:MoO_3. It is possible that co-evaporation of NPD:MoO_3 can be used as HTM in organometal halide perovskite solar cells.

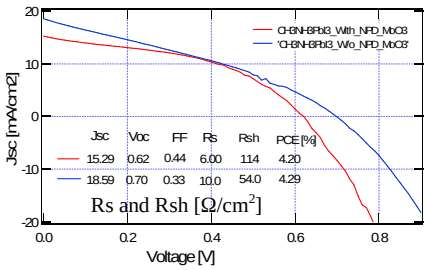

Fig. 1 J-V curves for Perovskite solar cells

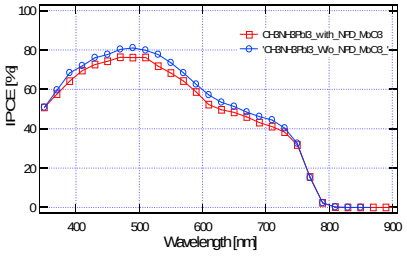

Fig.2 IPCE action spectra for solar cells with and without NPD:MoO_3 layers

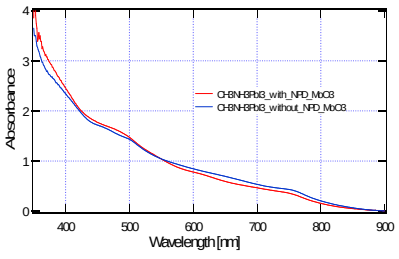

Fig.3 UV-Vis absorbance spectra of cells with and without NPD:MoO_3

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Refs. [1] Akihiro K., Kenjiro T., Yasuo S., and Tsutomu M., J.Am.Chem.Soc.,Article ASAP. DOI: 10.1021/ja809598r

[2] Jin Hyuck Heo, Sang Hyuk Im, Jun Hong Noh, Tarak N. Mandal, Choong-Sun Lim, et al.Yong Hui DOI: 10.1038/NPHOTON.2013.80

[3] Julian Burschka, Norman Pellet, Soo Jin Moon, Robin Humphry Baker, et al. DOI: 10.1038/nature12340