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$_2$O$_3$ scaffold/CH$_3$NH$_3$PbI$_3$/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$_3$NH$_3$PbI$_3$ 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$_3$NH$_3$PbI /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$_3$NH$_3$PbI$_3$/w NPD:MoO$_3$ and CH$_3$NH$_3$PbI$_3$/w/o NPD:MoO$_3$. The cells without NPD:MoO$_3$ shows a better PV properties in contrast to CH$_3$NH$_3$PbI$_3$/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$_3$NH$_3$PbI$_3$/w NPD:MoO$_3$ and CH$_3$NH$_3$PbI$_3$/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.

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