Electronic Supplementary Information for

Improved Charge Transport of Nb-Doped TiO_2 Nanorods in Methylammonium Lead Iodide Bromide Perovskite Solar Cell

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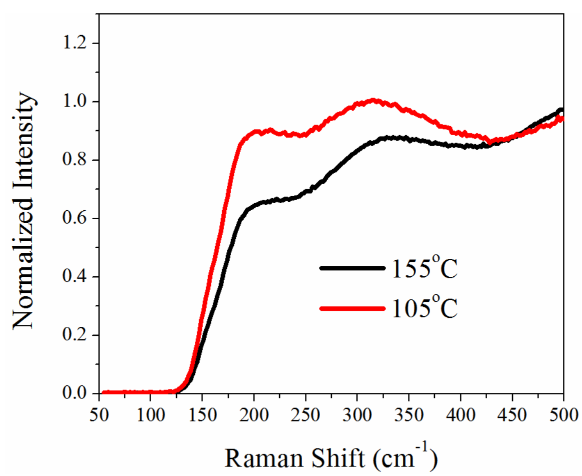

Figure S1. Raman spectra of perovskite baked at different temperatures, power used for 155°C baked sample is two orders higher than that of the sample baked at 105°C in order to obtain signals with good intensities.

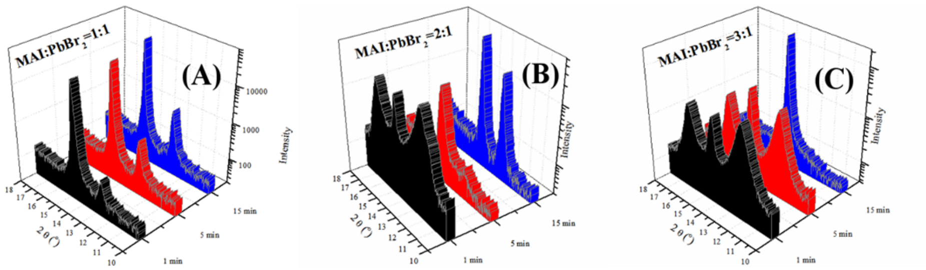

Figure S2. Evolution of XRD pattern for perovskite with different MAI:$PbBr_2$ ratios baked at 155^{o}C at different times (1 min, 5 min, 15 min). (A) MAI:$PbBr_2$=1:1, both the perovskite (~14°) and PbI_2 (12.6°) peaks emerges from the very beginning; (B) MAI:$PbBr_2$=2:1, intermediate phase at the early time, perovskite peak only, and PbI_2 peak shows up at 15 min; (C) MAI:$PbBr_2$=3:1, very long time of intermediate state, and only perovskite peak at 15 min.

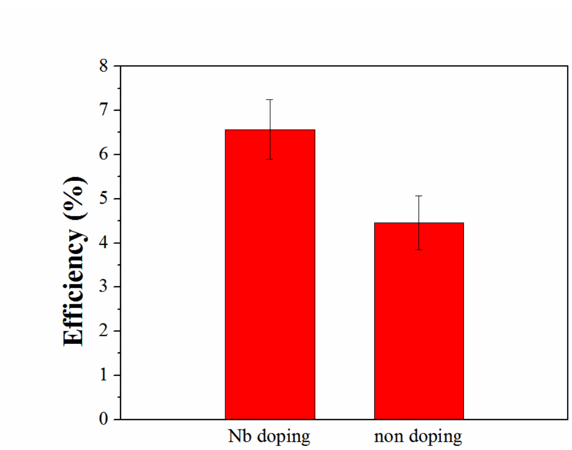

Figure S3. Average efficiency and standard deviation of devices made of 0.2% Nb-doped TiO_2 nanorods and nondoped TiO_2 nanorods (total sample number is eight).

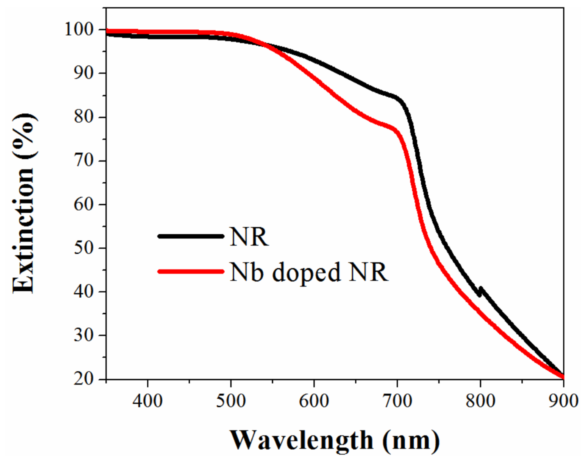

Figure S4. Extinction (including absorption and reflectance) spectra of perovskite films formed on NRs and Nb-doped NRs.

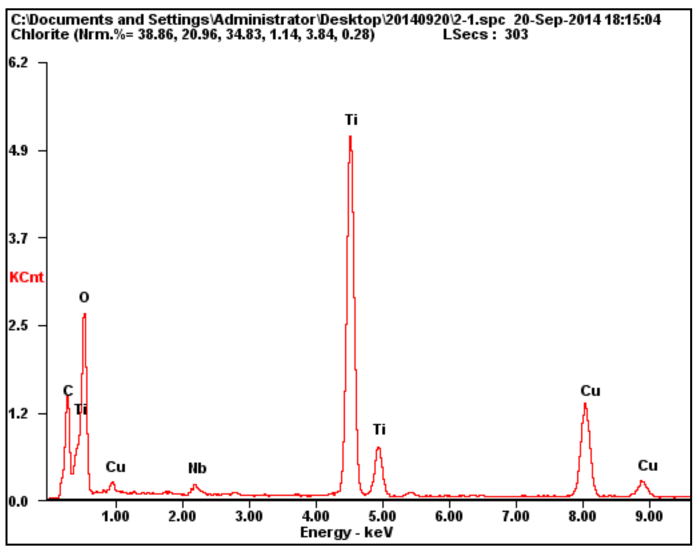

Figure S5. EDS of 1%Nb-doped nanorod. The EDS was taken using a JEM-2100F transmission electron microscope (TEM). The signal of Cu is from Cu grid used as the sample holder. Due to the low doping level of Nb in the 0.2% Nb-doped sample, the Nb is not detectable. To demonstrate the successful doping of Nb into the TiO_2 nanorods, 1% Nb-doped sample was used for the TEM EDS experiment.