Supplementary Information

Surfactant Tween 20 Controlled Perovskite Film Fabricated by Thermal Blade Coating for Efficient Perovskite Solar Cells

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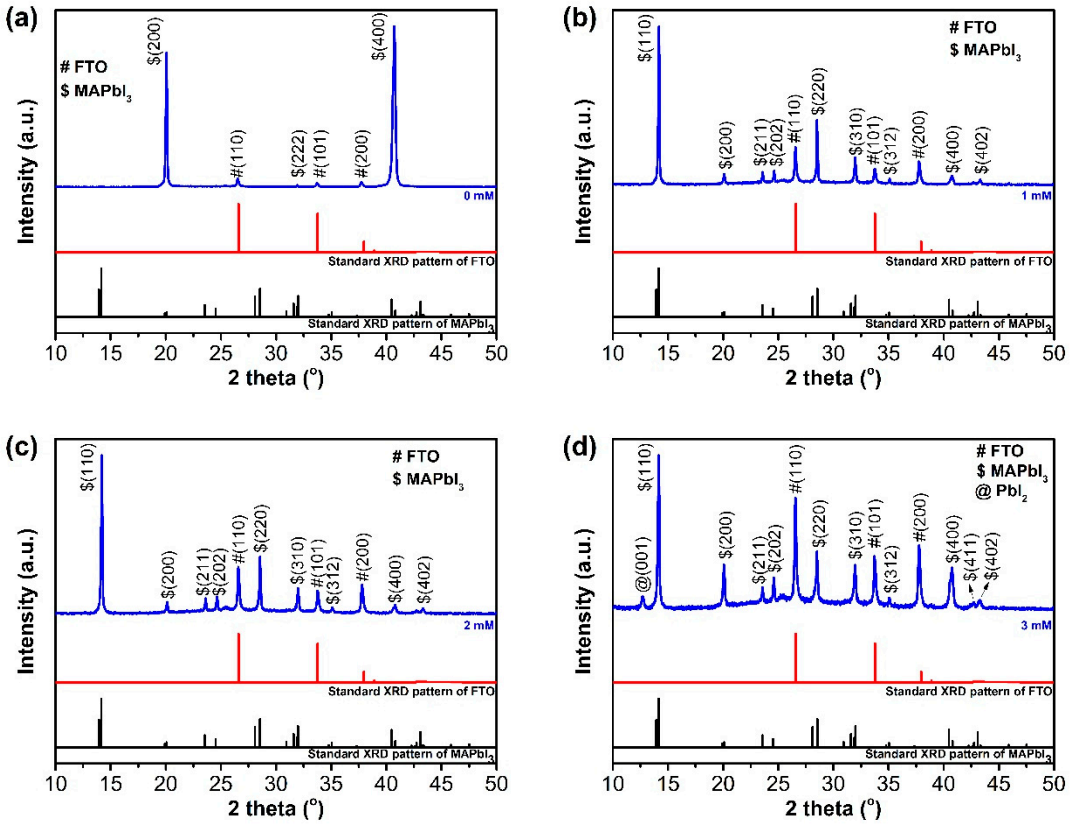

Fig. S1. The XRD patterns of the perovskite films with different concentration Tween 20, and the reference standard for $MAPbI_3$ and FTO.

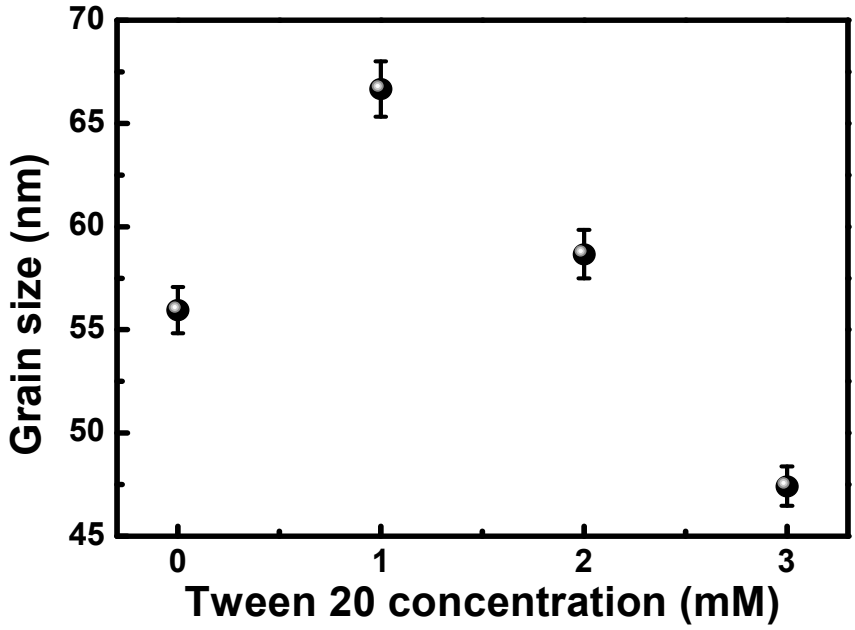

Fig. S2. The grain size of perovskite films without and with different Tween 20 concentrations.

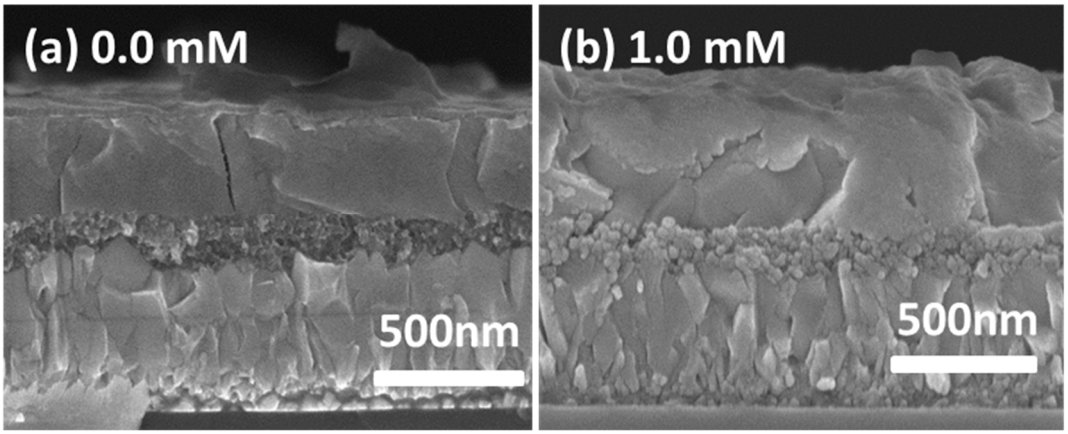

Fig. S3. FE-SEM images of cross-section PSC (a) without and with 1.0 mM Tween 20.

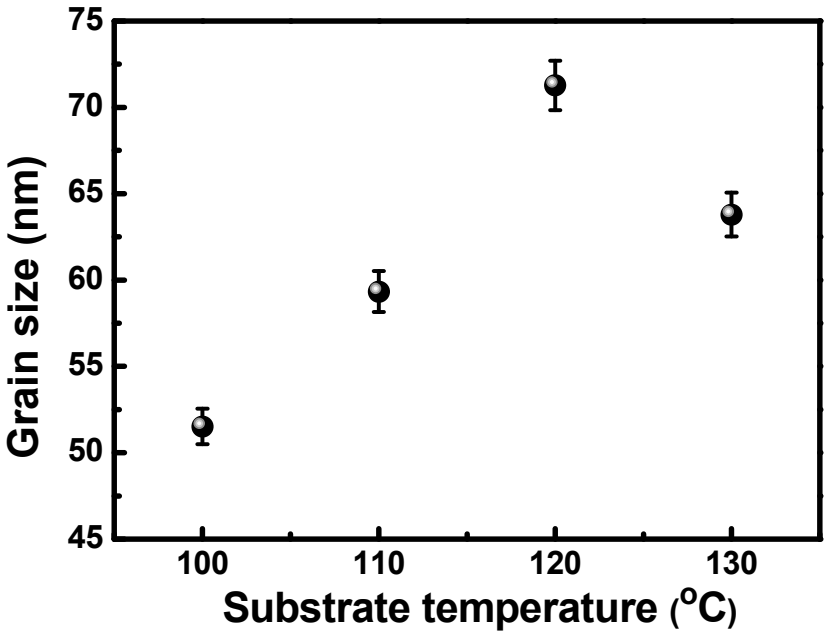

Fig. S4. The grain size of perovskite films with 1.0 mM Tween 20 with different fabrication temperatures.

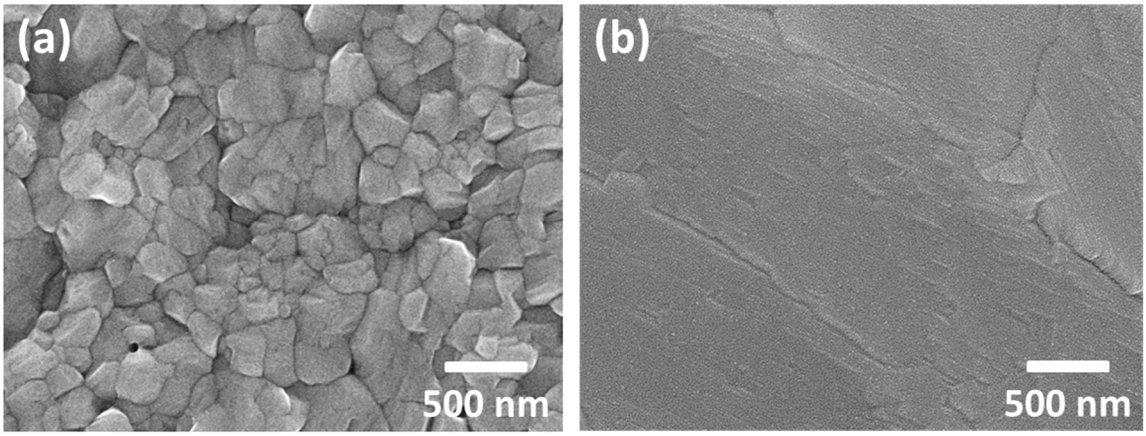

Fig. S5. The top-view surface morphologies of perovskite film with 1.0 mM Tween 20 under two different preparation methods, including (a) spin coating and (b) thermal assisted blade coating method.

Table. S1. The morphological characteristics (Ra and RMS) of perovskite films with various Tween 20 concentrations by using AFM measurement.

Concentration of Tween 20 (mM)	Ra (nm)	RMS (nm)
0	110.3	140.5
1	52.1	67.9
2	103.6	130.6
3	120.7	148.8