Supporting Information

Grain engineering by ultrasonic substrate vibration post treatment of wet perovskite films for annealing-free, high performance, and stable perovskite solar cells

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Table S1 Average PV parameters of the PSCs fabricated with the SVPT and TA.

Perovskite film	J_{SC} (mA/cm²)	V_{OC} (V)	FF %	PCE %
TA (110 °C - 10 min)	19.35	1.07	60.93	12.96
SVPT (5 W - 1 min)	19.28	1.07	41.75	8.46
SVPT (5 W - 2 min)	18.36	1.05	51.76	9.95
SVPT (5 W - 3 min)	20.80	1.06	59.44	13.23
SVPT (5 W - 4 min)	23.64	1.1	66.23	17.23
SVPT (10 W - 1 min)	21.76	1.06	64.84	15.06
SVPT (10 W - 2 min)	21.96	1.10	62.64	15.12
SVPT (10 W - 3 min)	20.83	1.05	55.47	12.16
SVPT (10 W - 4 min)	18.54	1.08	58.35	11.79

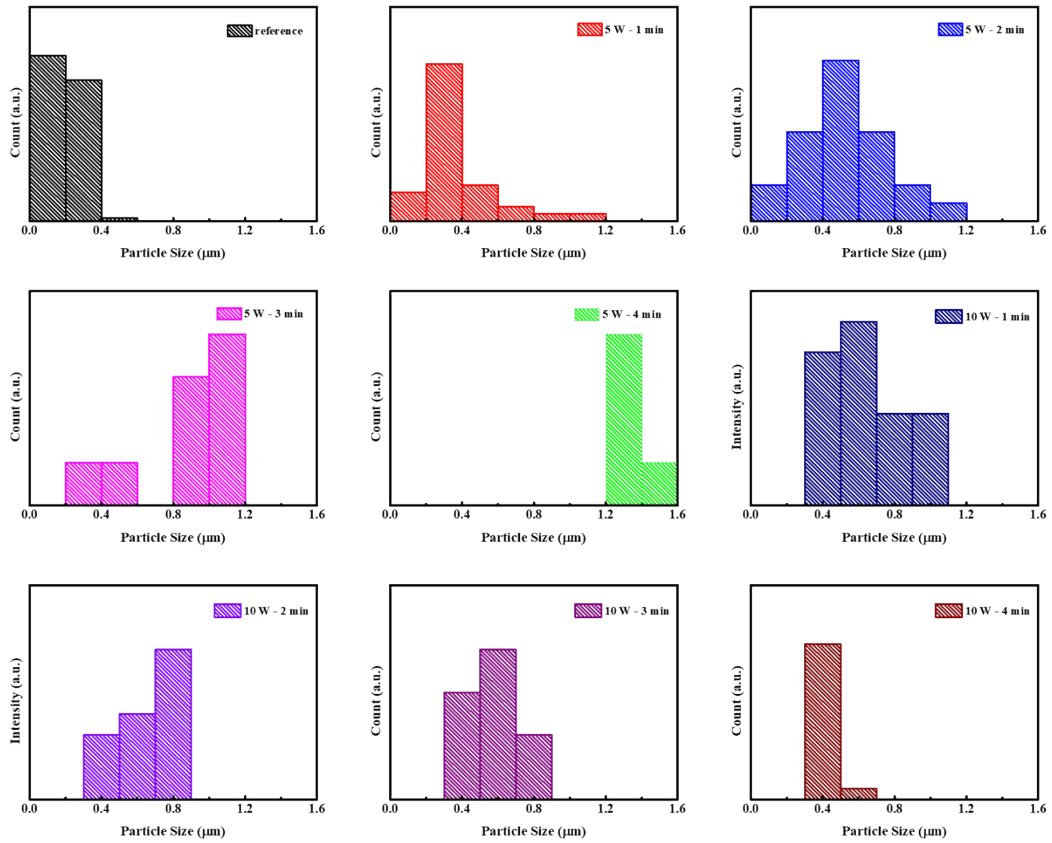


Figure S1- Histograms of grain size distribution of $(FAPbI_3)_{0.85}(MAPbBr_3)_{0.15}$ thin films, prepared by spin coating, followed by thermal annealing (TA), and the substrate vibration post treatment (SVPT) at varying vibration powers and times.

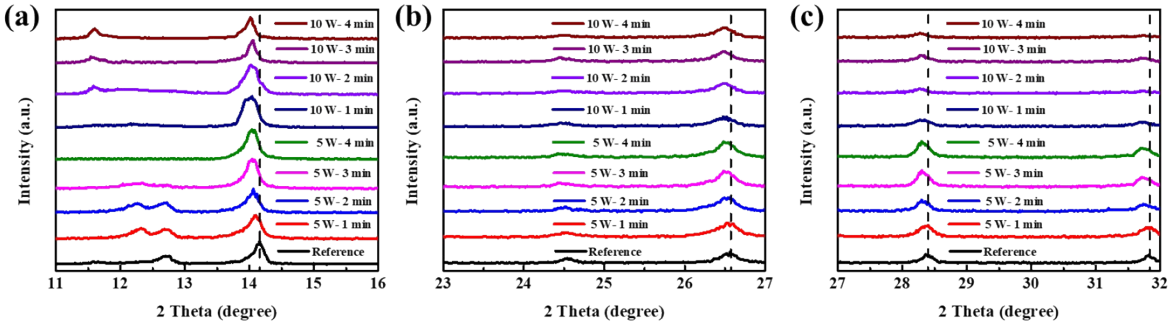
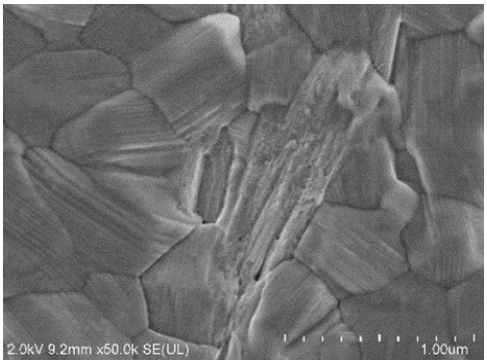
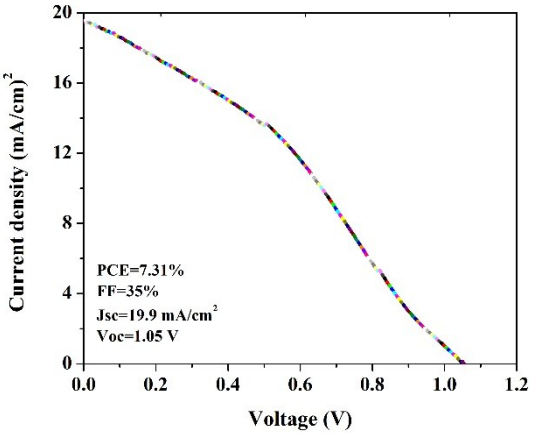


Figure S2- Main perovskite XRD peaks of SVPT samples demonstrate a minor displacement (left-shift) with respect to one another and the TA sample.





(a) (b)

Figure S3- (a) Top-view SEM image of $(FAPbI_3)_{0.85}(MAPbBr_3)_{0.15}$ thin film made with SVPT at 5 W - 5 min and (b) the J-V behavior of the corresponding PSC. Excessive power of the vibration deteriorates the film morphology and device performance.