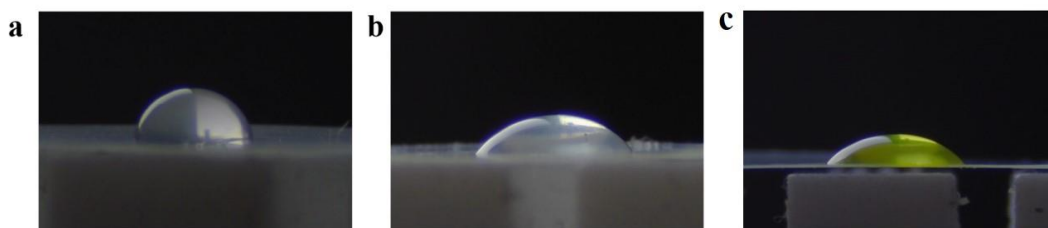
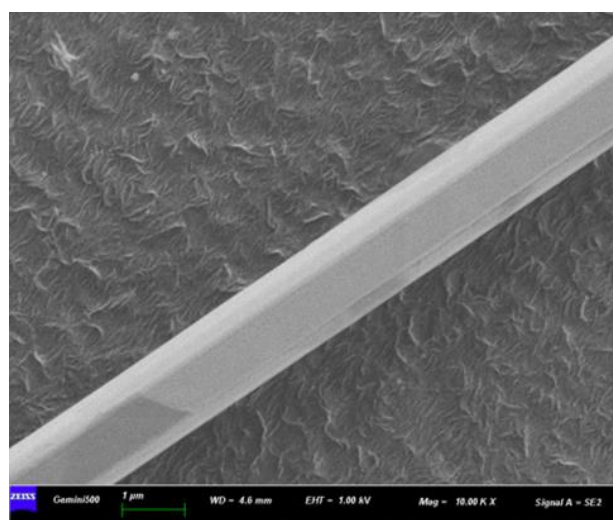


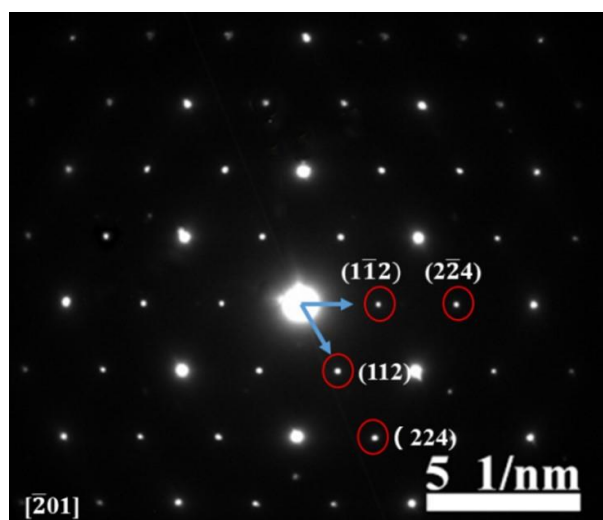
## Electronic Supplementary Information



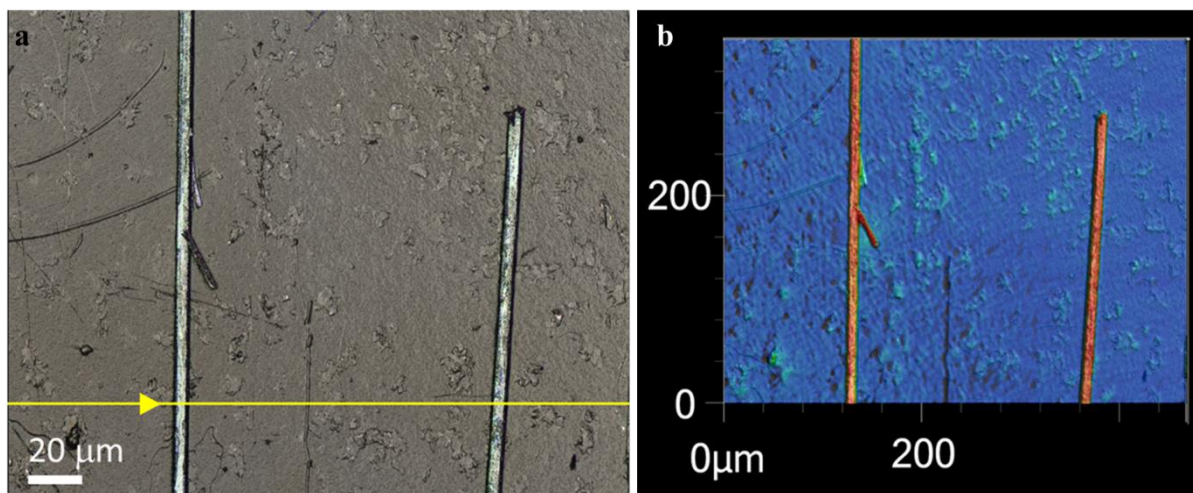
**Figure S1.** The contact angles of (a) H<sub>2</sub>O/PEM and (b) DMF/PEM (c) precursor DMF solution/PEM.



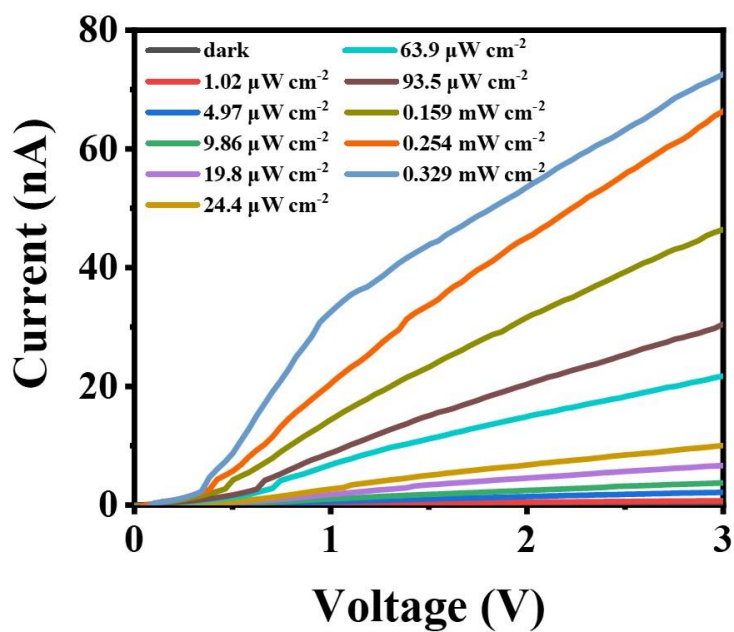
**Figure S2.** FESEM image of thin MAPbI<sub>3</sub> MW.



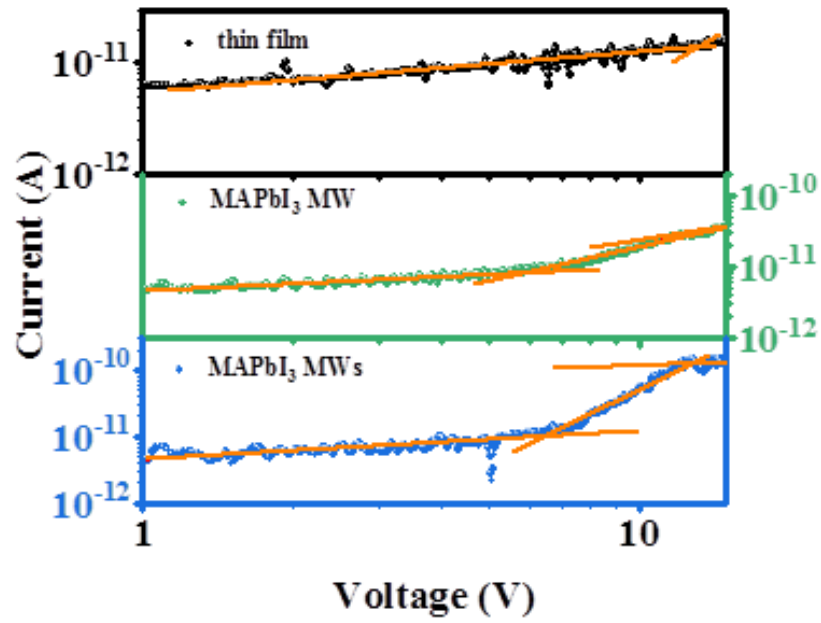
**Figure S3.** Selected area electron diffraction pattern of MAPbI<sub>3</sub> MW.



**Figure S4.** (a) 2D and (b) 3D laser optical micrographs of MAPbI<sub>3</sub> MWs.



**Figure S5** I-V curves of MAPbI<sub>3</sub> MW arrays under 523 nm LED illumination with different light intensities at 3 V bias.



**Figure S6** I-V plots of single-crystal MAPbI<sub>3</sub> MW, MW arrays, and thin film by space charge limited current method.