Supporting Information

Large-Area Perovskite Nanowire Arrays Fabricated by Large-Scale Roll-to-Roll Micro-gravure Printing and Doctor Blading

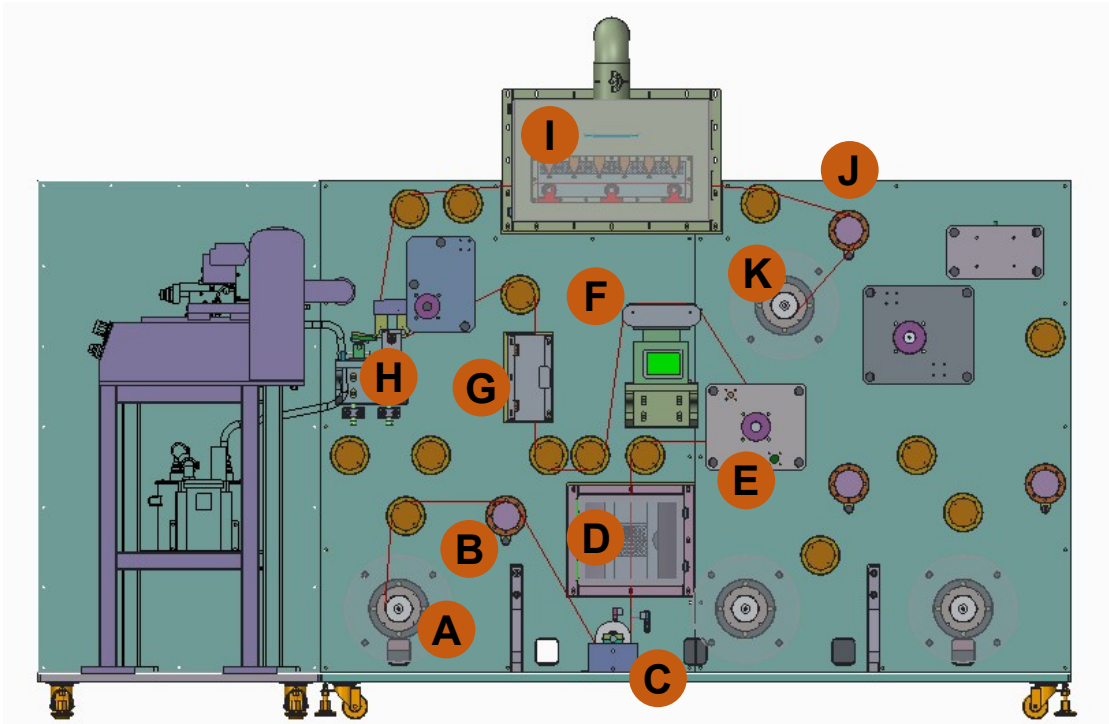
Qiao Hu,[a] Han Wu, [a] Jia Sun,[a] Donghang Yan, [b] Yongli Gao,[ac] Junliang Yang [ab]*

[a]*Institute of Super-microstructure and Ultrafast Process in Advanced Materials, Hunan Key Laboratory for Super-microstructure and Ultrafast Process, School of Physics and Electronics, Central South University, Changsha 410083, Hunan, China*

[b]*State Key Laboratory of Polymer Physics and Chemistry, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun 130022, China*

[c]*Department of Physics and Astronomy, University of Rochester, Rochester, NY 14627, USA.*

* Corresponding author: junliang.yang@csu.edu.cn; +86-731-88660256 (J. L. Yang)



A：un-winding roller　　B：tension-sensor roller
C：cleaning tank　　D：drying oven
E：traction roller　　F：deviation adjusting unit
G：corona unit　　H：microgravure printing unit
I：drying oven　　J：tension-sensor roller
K：re-winding roller

Fig. S1. The structural schematic of self-developed R2R multi-function micro-gravure printer. The printing machine is composed of cleaning unit, deviation adjusting unit, corona unit, drying units, micro-gravure printing unit, un-winding roller, re-winding roller, tension-sensor rollers, traction roller, and several transfer rollers. The web moves with the help of traction roller, and they have the same moving speed. The moving direction of web is from A to K.

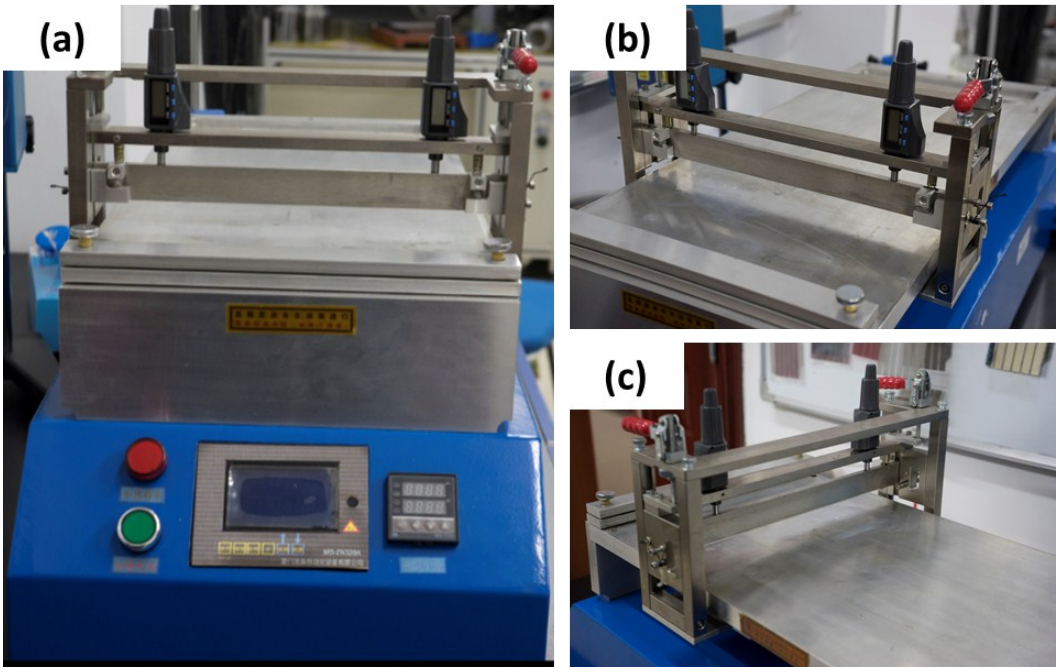


Fig. S2. Photo of doctor-blading machine from different view angles. The plate doctor blading was processed using a commercial machine with a heating unit (ZN320, Maosen, Fujian). The stainless steel blade is a rectangular bar with a blading angle of 45^{o}, and the blading speed is fixed at 0.6 m/min (The range of blading speed can be adjusted from 0.2 m/min to 2 m/min). The thickness or density of PNWs could be controlled by the solution concentration of perovskite precursor and the distance between the blade and the substrate. The thickness precision of wet film is about 10 μm.

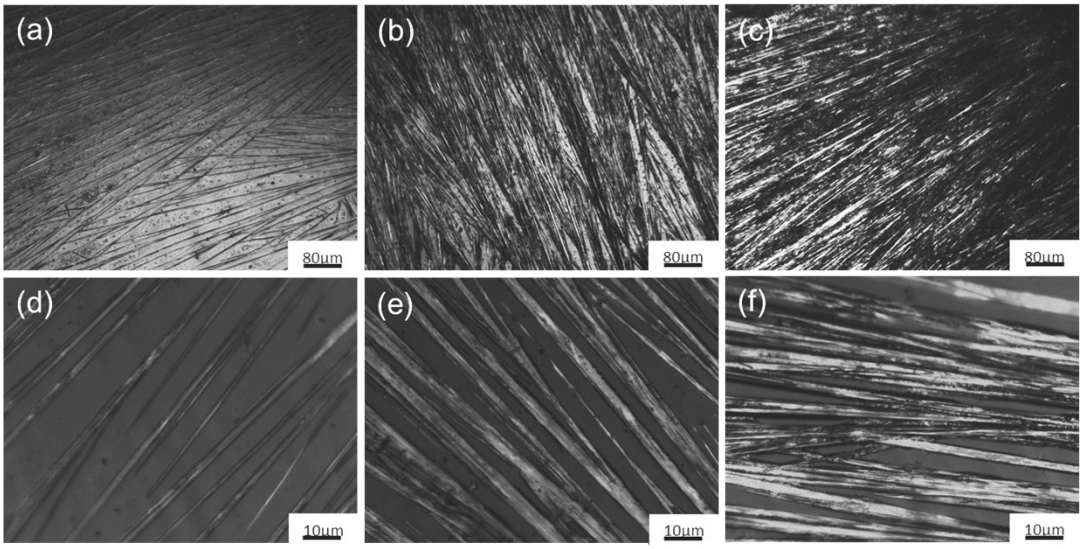


Fig. S3. Optical microscopy images of $CH_3NH_3PbI_3$ NWs prepared by doctor-blading on PET substrates with $CH_3NH_3PbI_3$ precursor concentrations of (a, d) 50 mg/ml, (b, e) 220 mg/ml, (c, f) 350 mg/ml. As shown in Fig.S2, with increasing the concentration of $CH_3NH_3PbI_3$ solution, the denser and longer PNWs could be obtained because more $CH_3NH_3PbI_3$ materials could be provided by the solution with a higher concentration.

Video S1. The growth of highly oriented, large-area PNWs arrays viewed from an *in-situ* optical microscopy.