Supporting information

Writable, patternable organic solar cells and modules inspired from old Chinese calligraphy tradition

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Table S1 Quotes and properties of coating facilities for organic solar cells

Coating technique	**An example of facility (model, vendor and price)**	**Highest reported PCE[b], active layer used and device area**	**Printing speed**	**Technical maturity for large-area (>1 m^2) production**
Doctor blade	(ZAA2320.H, ZUA2000), Zehntner GmbH Testing Instruments, USD15,000	9.5%[1], PffBT4T-2OD : $PC_{71}BM$, 4 mm^2	0.6-4.5m/min [2-5]	Well-developed
Inkjet printing	(Pixdro LP50) Meyer Burger Technology, USD50,000[a]	5%[6], PCDTBT:$PC_{71}BM$, 0.5 cm^2	2-10 m/min[7-10]	Well-developed
Slot-die coating	(mini roll coater) FOM TECHNOLOGIES, USD70,000[a]	7.5%[11], PTB7-Th:$PC_{71}BM$, 4.15 cm^2	0.6-10 m/min[12-17]	Well-developed
Maobi coating	Maobi + motor, home made, USD3,000	10.1% (this work), PBDB-T:ITIC, 10 mm^2	0.3-1.5 m/min	To be further developed

[a] Depending on the selection of inkjet nuzzles or slot-die coating heads.

[b] The PCE is dependent on the effective area and active layers used.

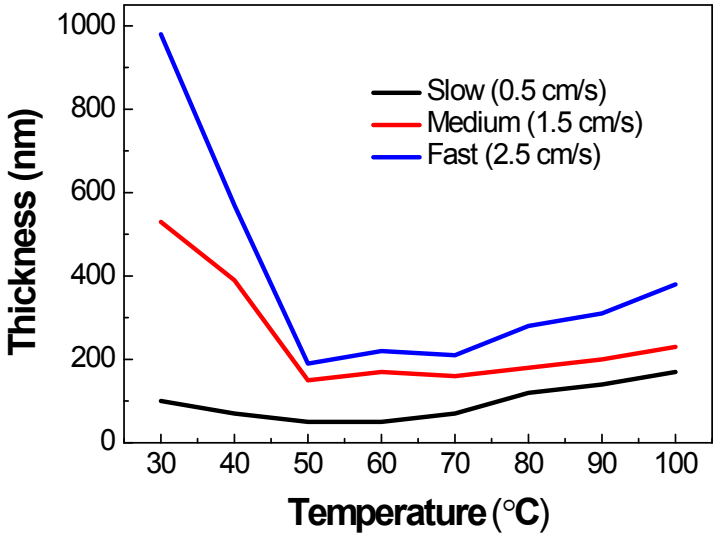

Figure S1. Effect of substrate temperature and writing speed on thickness of Maobi-coated P3HT:ICBA films.

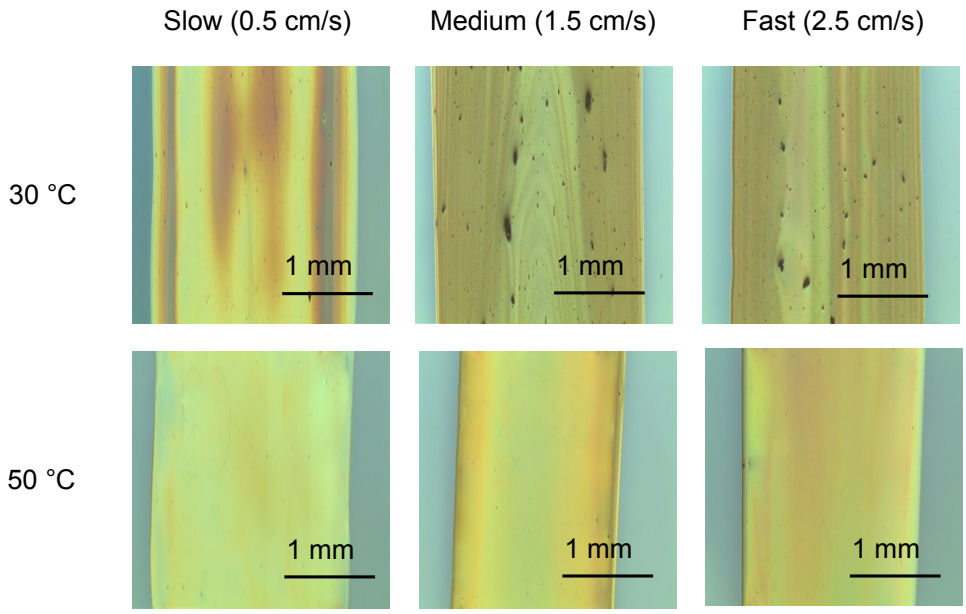

Figure S2. Optical images of P3HT:ICBA thin film Maobi-coated at different temperature and coating speed.

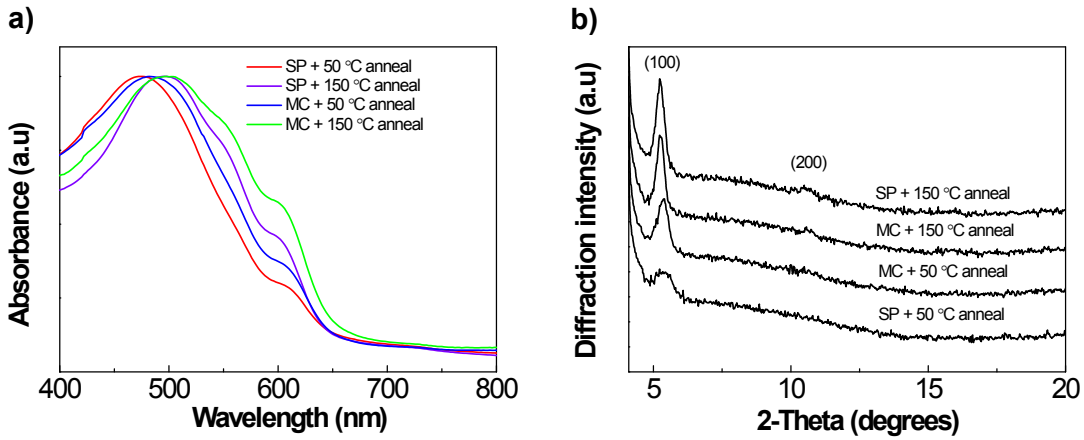

Figure S3. UV-Vis absorbance spectra and X-ray diffraction obtained for P3HT:ICBA thin films (thickness ~ 180 nm) prepared by spin coating (SP) and Maobi coating (MC). The Maobi coating was performed with substrate temperature of 50 °C. The films were then annealed at 50 and 150 °C for 10 min.

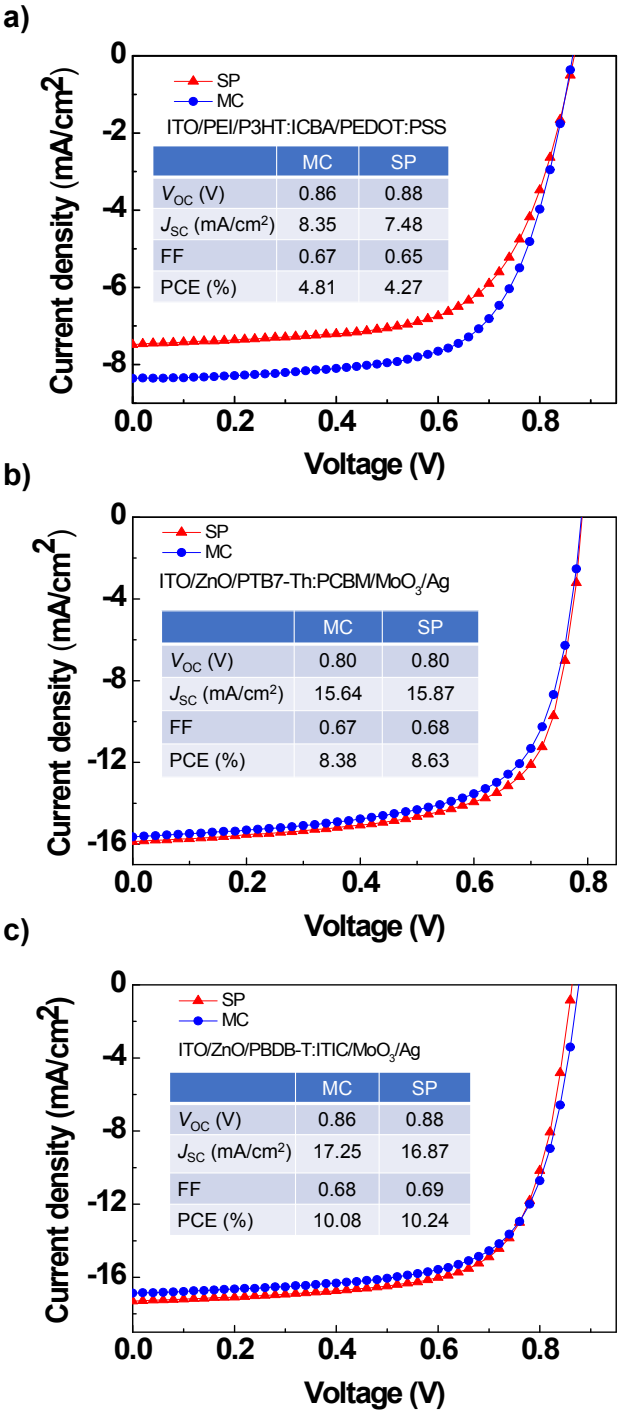

Figure S4. *J-V* characteristics of cells with spin-coated (SP) and Maobi-coated (MC) active layer: a) P3HT:ICBA; b) PTB7-Th:$PCB_{71}M$ and c) PBDB-T:ITIC.

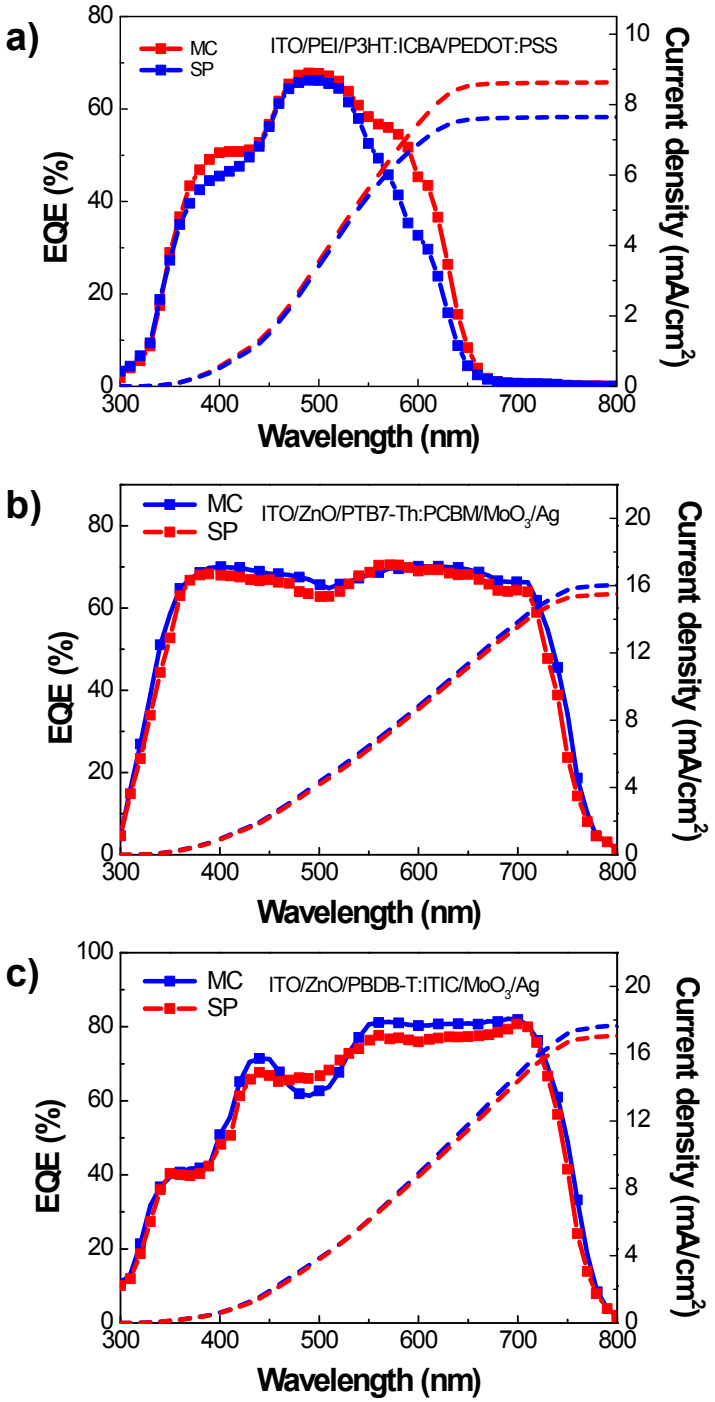

Figure S5. External quantum efficiency of cells with spin-coated (SP) and Maobi-coated (MC) active layer: a) P3HT:ICBA; b) PTB7-Th:$PCB_{71}M$ and c) PBDB-T:ITIC.

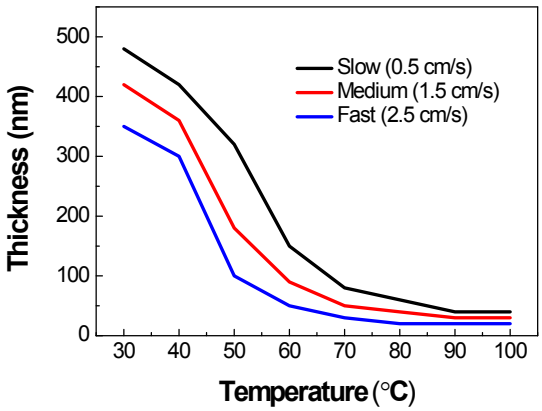

Figure S6. Effect of substrate temperature and coating speed on thickness of Maobi-coated PEDOT:PSS films.

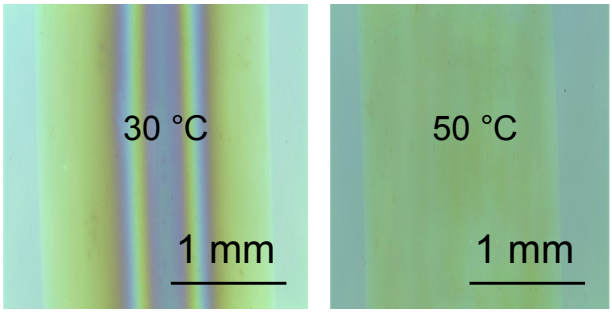

Figure S7. Optical images of PEDOT:PSS written at 30 and 50 °C. The coating speed is 1.5 cm/s.

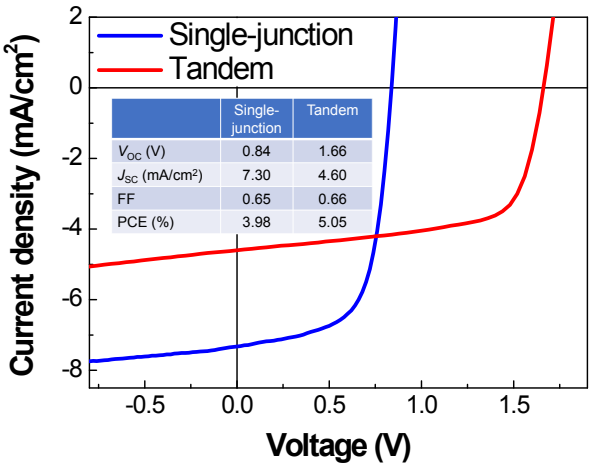

Figure S8. *J-V* characteristics of a) single-junction (ITO/PEI/P3HT:ICBA/PEDOT:PSS); and b) tandem solar cell (ITO/PEI/P3HT:ICBA/PEDOT:PSS/PEI/P3HT:ICBA/PEDOT:PSS) with Maobi-coated PEDOT:PSS electrodes (the rest layers are spin-coated).

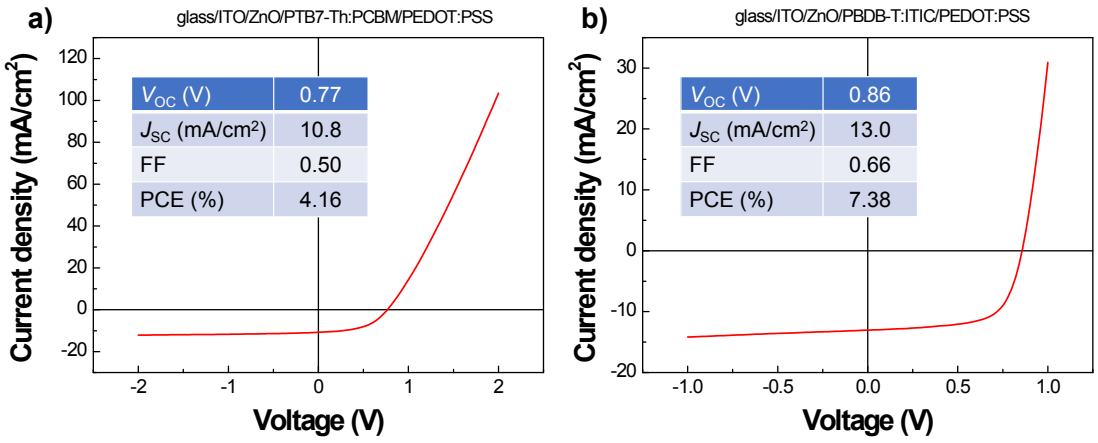

Figure S9. *J-V* characteristics of devices with structure of a) glass/ITO/ZnO/PTB7-Th:PCBM/PEDOT:PSS; and b) glass/ITO/ZnO/PBDB-T:ITIC/ PEDOT:PSS. The PEDOT:PSS electrodes are Maobi-coated.

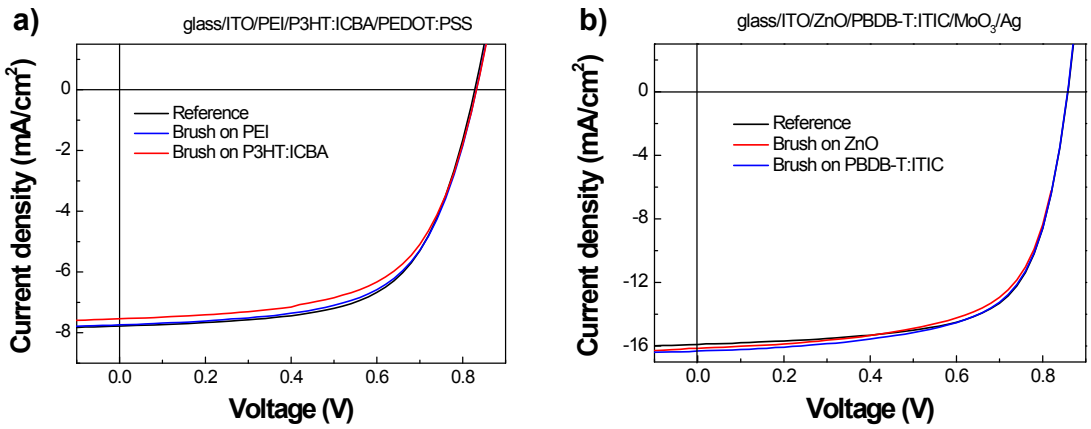

Figure S10. *J-V* characteristic of devices with active layer or interfacial layer intentionally brushed by dry clean Maobi to test if the contact of Maobi with the layers would influence the solar cell performance. PEDOT:PSS layer is Maobi-coated and the rest is spin-coated.

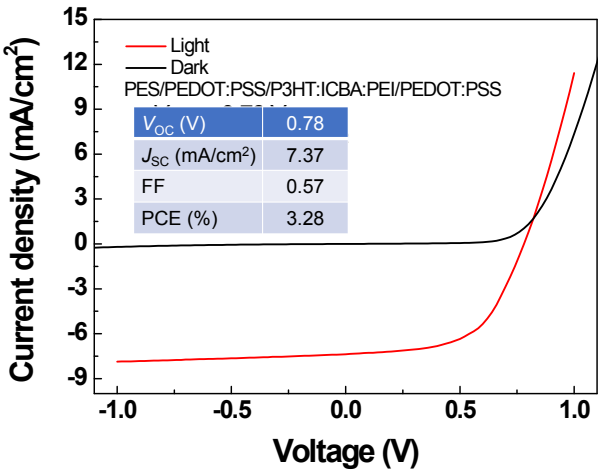

Figure S11. *J-V* characteristics of flexble all-plastic fully Maobi-coated OSCs with structure of PES/PEDOT:PSS/P3HT:ICBA:PEI/PEDOT:PSS.

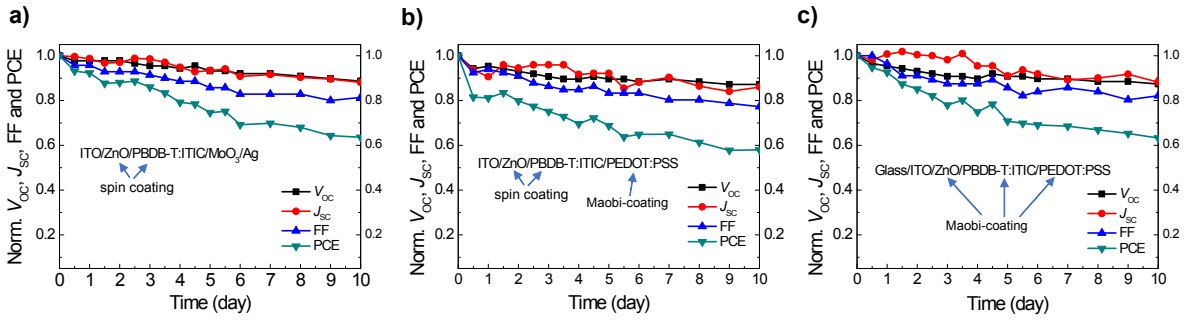

Figure S12. Normalized photovoltaic parameters as a function time of the three types of cells kept in the dark in air with a relative humidity of 50%.

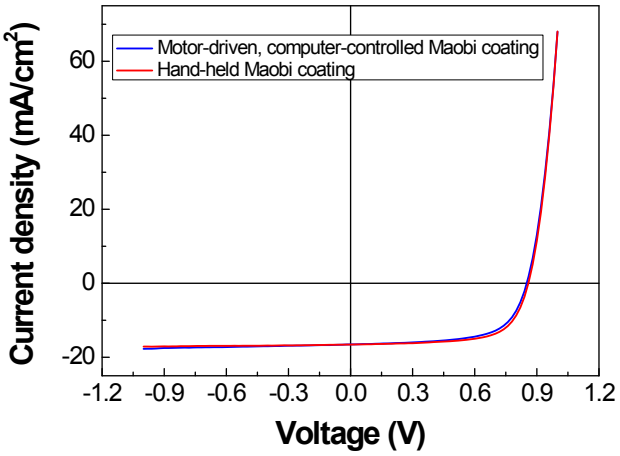

Figure S13. *J-V* characteristics of organic solar cells (glass/ITO/ZnO/PBDB-T:ITIC/MoO_3/Ag) prepared in the same batch where the PBDB-T:ITIC active layers were prepared by Maobi coating. One is hand-held Maobi coating, and the other is motor-driven computer-controlled Maobi coating.

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