

Enhancing stability of perovskite solar cells to moisture by the facile hydrophobic passivation

Insung Hwang,^a Inyoung Jeong,^{b,c} Jinwoo Lee,^b Min Jae Ko,^{c,d} and Kijung Yong^{*a}

a: Surface Chemistry Laboratory of Electronic Materials, Department of Chemical Engineering, Pohang University of Science and Technology (POSTECH), Hyoja-Dong, Pohang-Si, 790-784, Republic of Korea

b: Advanced Functional Nanomaterial Laboratory, Department of Chemical Engineering, Pohang University of Science and Technology (POSTECH), Hyoja-Dong, Pohang-Si, 790-784, Republic of Korea

c: Photo-Electronic Hybrids Research Center, Korea Institute of Science and Technology (KIST), Seoul 136-791, Republic of Korea

d: KU-KIST Graduate School of Converging Science and Technology, Korea University, Seoul 136-701, Republic of Korea

E-mail: kyong@postech.ac.kr

Tel) +82-54-279-2278 Fax) +82-54-279-8619

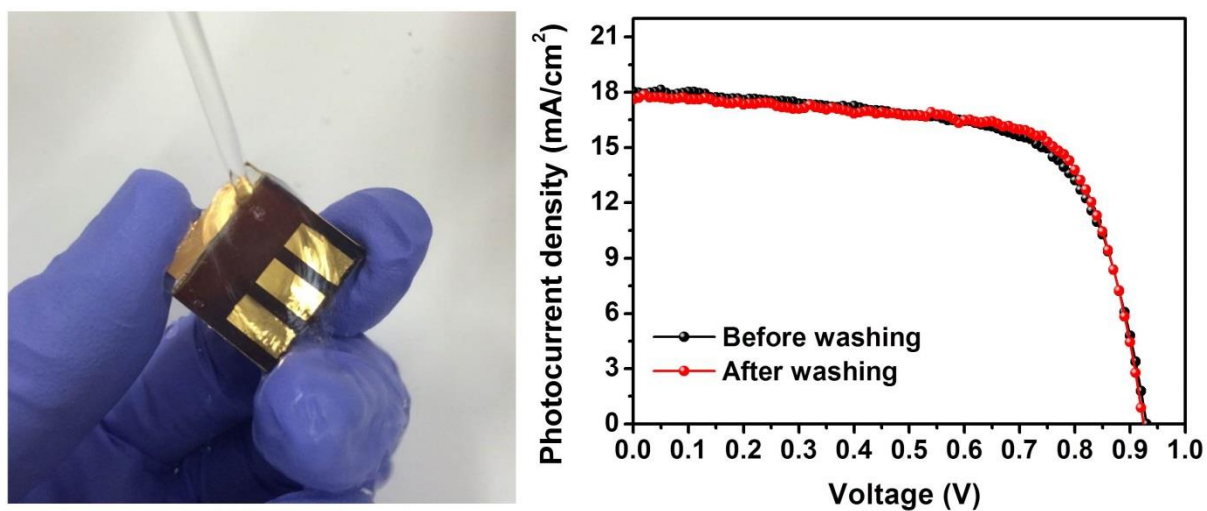


Figure S1. Digital photograph of Teflon-PSC under the falling water (left). After the exposure to the running water for 60 seconds, J-V characteristic of the Teflon-PSC was measured and plotted (right). Teflon-PSC showed negligible difference in the J-V curve before and after the washing.

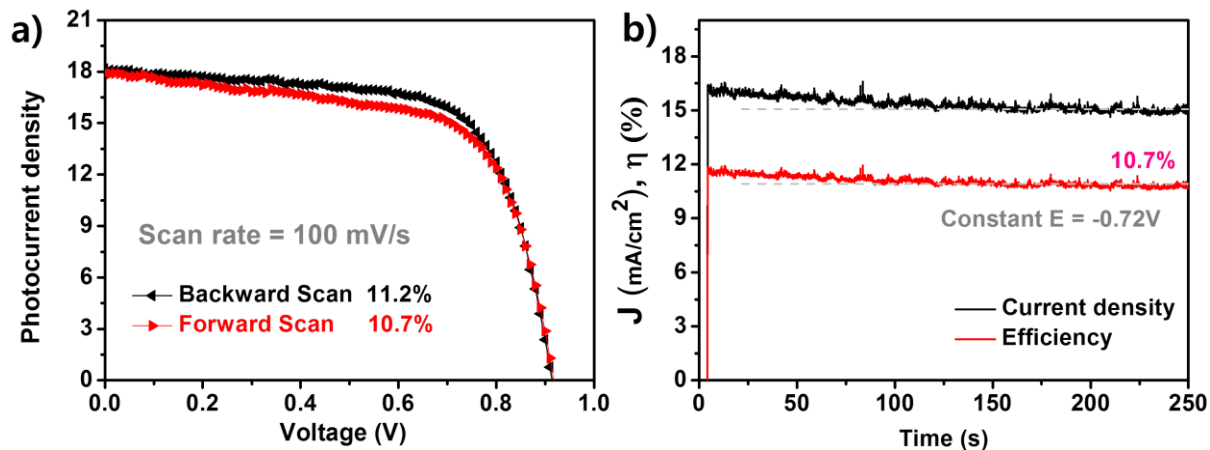


Figure S2. a) J-V curves of the as-fabricated perovskite solar cell, depending on the scan direction of the measurement. For the backward scan (BS), scan range was from -1.1V to 0.2V and the scan rate was 100mV/s. For the forward scan (FS), the range was from 0.2V to -1.1V with the same scan rate of 100mV/s. As the usual cases of mesoscopic perovskite solar cells, a slight hysteresis was observed. b) stabilized efficiency and photocurrent curves, measured under the illumination of 1 sun and the constant bias voltage of -0.72V. The bias voltage was chosen by the maximum power point in the J-V curves, as suggested by Snaith et al.¹ Note that: unlike the measuring condition in the reference (slightly and slowly varying applied bias potential), the stabilized-efficiency measurement in this experimental was conducted at the constant bias voltage.

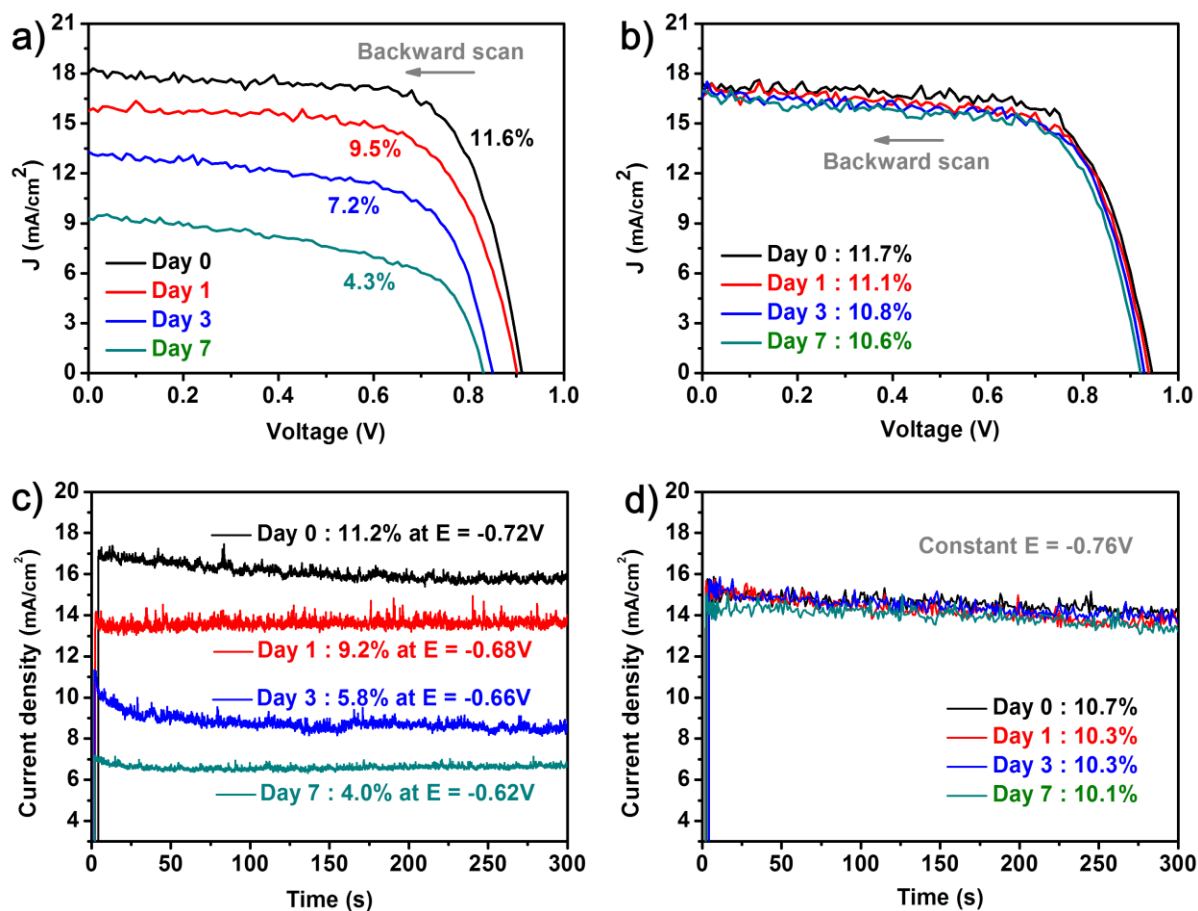


Figure S3. J-V curves of the pristine PSC (a) and Teflon-PSC (b) stored in the humidity-controlled chamber with the humidity of 50% at room temperature. Because of the harsh humidity, pristine PSC exhibited rapid degradation of the power conversion efficiency. On the other hand, Teflon-PSC showed enhanced resistance to the humidity. As were in Figure S2, stabilized efficiencies of the pristine PSC (c) and Teflon-PSC (d) were measured. As already observed, pristine PSC showed considerably decreased current density with the storage time, while Teflon-PSC showed negligible differences in the current density. All stabilized efficiencies were measured at the maximum power point of each sample.

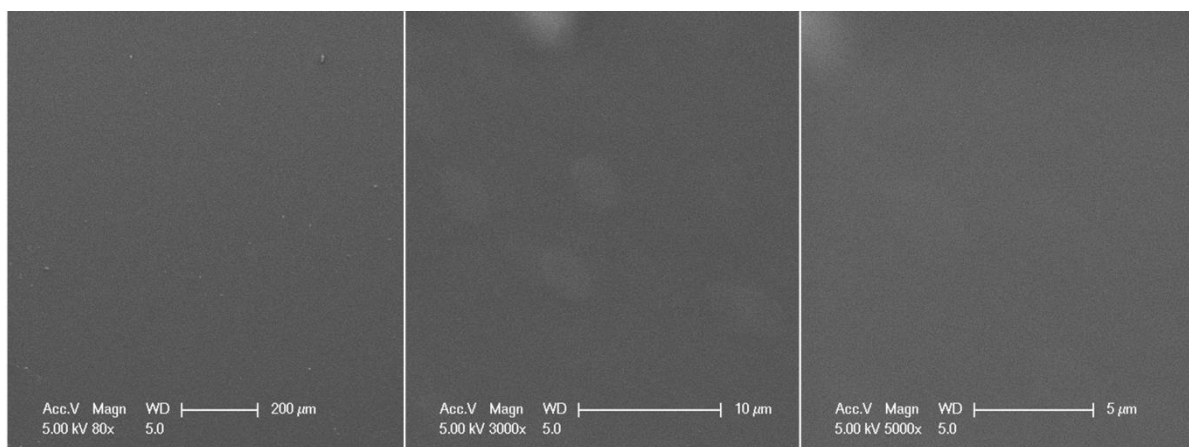


Figure S4. Top-view of SEM (scanning electron microscope) image of Teflon film on the device. No pin-hole was observed in the film. Since the film is polymer with poor conductivity, images under high-resolution condition were not clear.

References

1. Snaith, H. J.; Abate, A.; Ball, J. M.; Eperon, G. E.; Leijtens, T.; Noel, N. K.; Stranks, S. D.; Wang, J. T.-W.; Wojciechowski, K.; Zhang, W., Anomalous Hysteresis in Perovskite Solar Cells. *J. Phys. Chem. Lett.* **2014**, *5*, 1511-1515.