

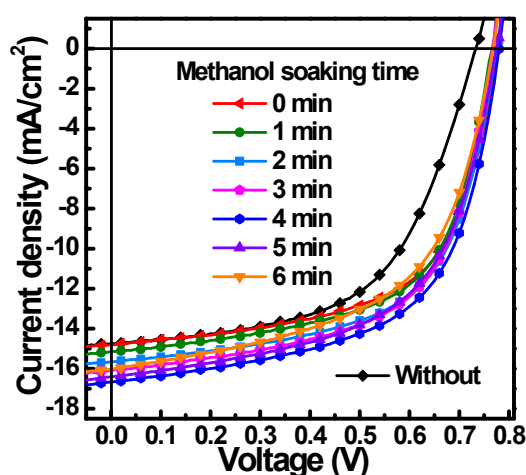
## Two-steps strategy to clarify the roles of solution processed PFN interfacial layer in efficient polymer solar cells

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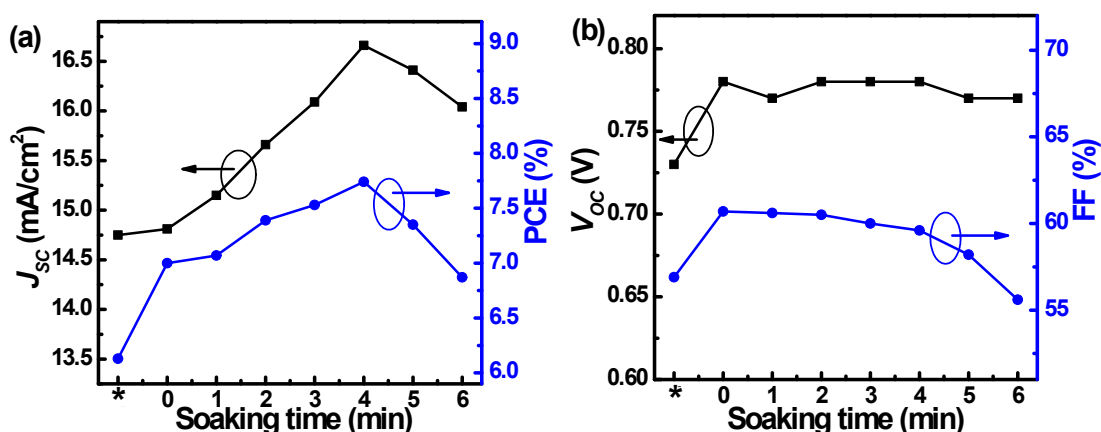
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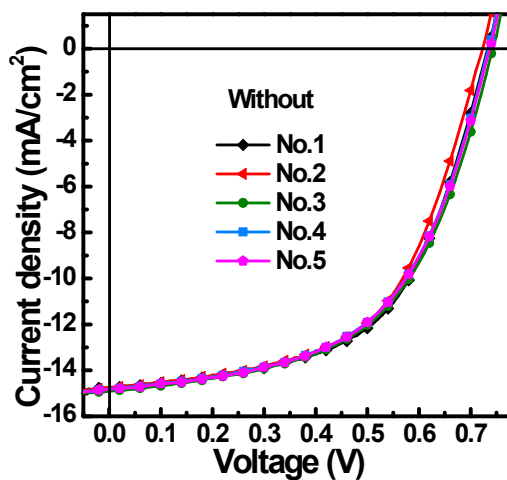


**Fig. S1** The  $J$ - $V$  characteristic curves of PSCs without or with different methanol soaking time under AM1.5G illumination at intensity of  $100 \text{ mW/cm}^2$ .

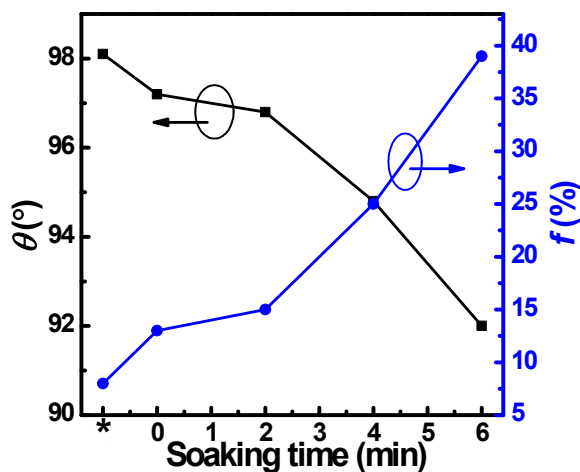


**Fig. S2** The  $V_{oc}$ , FF,  $J_{sc}$  and PCE of PSCs dependence on the methanol soaking time. (\* indicates without methanol treatment).

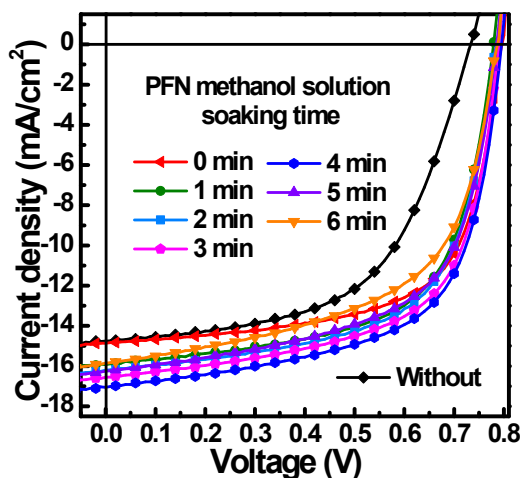
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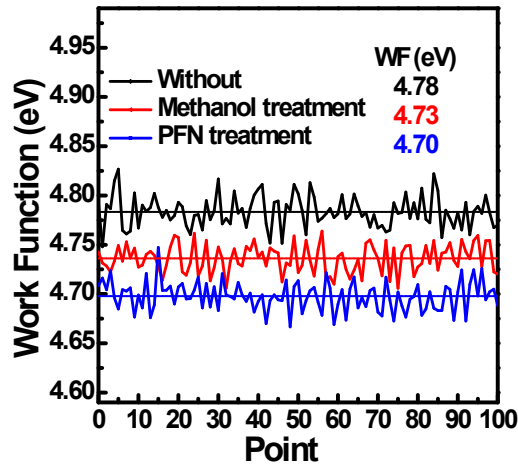
**Fig. S3** The  $J$ - $V$  curves of PSCs without methanol treatment under AM1.5G illumination at  $100 \text{ mW/cm}^2$  prepared from different batches.



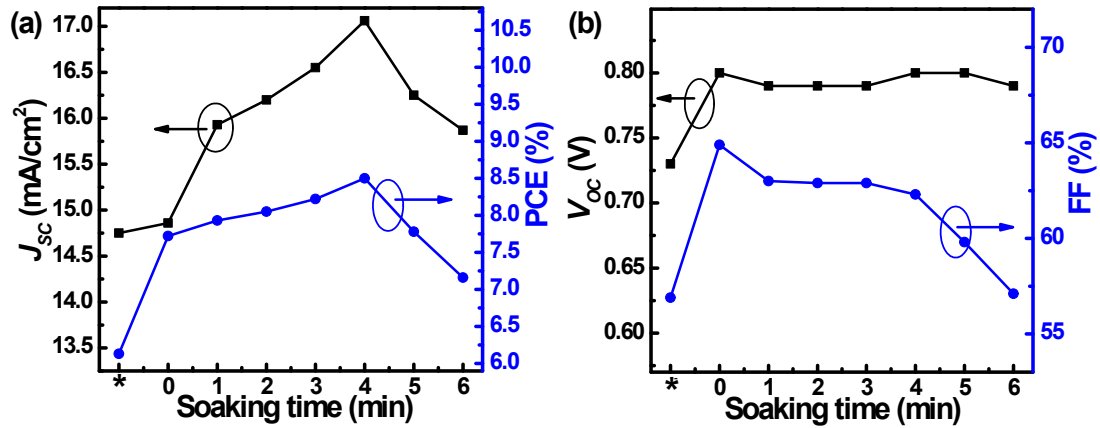
**Fig. S4** Water contact angle the  $\text{PC}_{71}\text{BM}$  surface coverage of the top surface blend film dependence on the methanol soaking time. (\* indicates without methanol treatment)



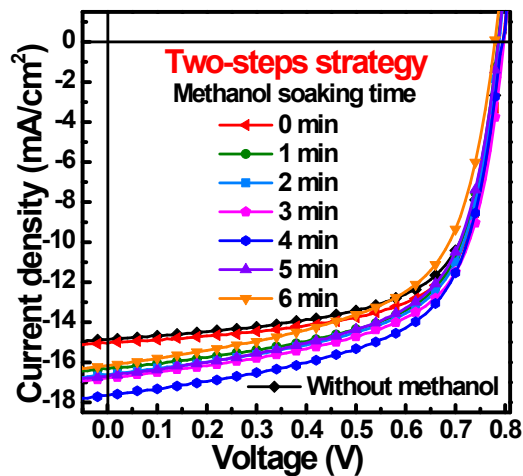
**Fig. S5** The  $J$ - $V$  curves of PSCs with different PNF methanol solution soaking time under AM1.5G illumination at  $100 \text{ mW/cm}^2$ .



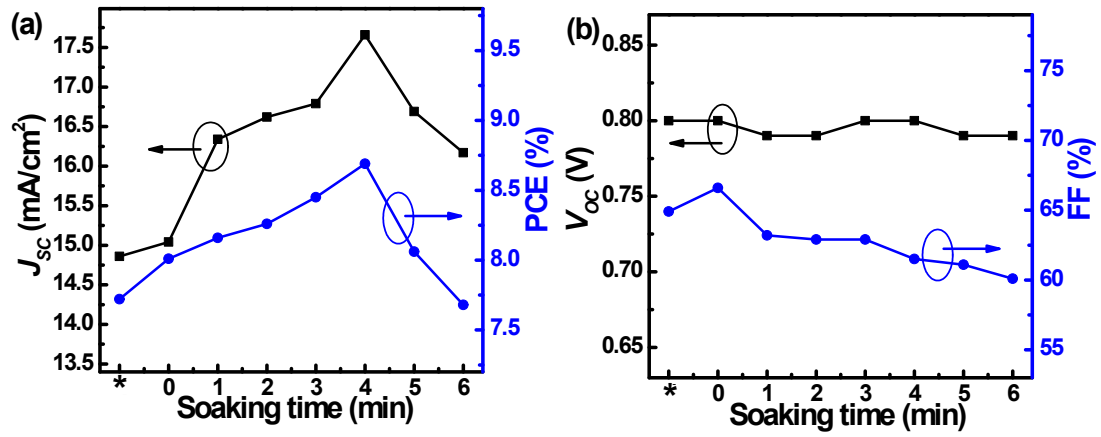
**Fig. S6** The work functions of active layers with (without) methanol or PFN methanol solution treatment.



**Fig. S7** The  $V_{oc}$ , FF,  $J_{sc}$  and PCE of PSCs dependence on the PFN methanol solution soaking time. (\* indicates without methanol treatment)



**Fig. S8** The  $J$ - $V$  curves of PSCs with the two-steps strategy or only spin-coating PFN methanol solution under AM1.5G illumination at 100 mW/cm<sup>2</sup>.



**Fig. S9** The  $V_{oc}$ , FF,  $J_{sc}$  and PCE of PSCs with the two-steps strategy dependence on the methanol solution soaking time. (\* indicates without methanol treatment and directly spin-coating PFN methanol solution on the active layer)