Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.
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Supporting Information

Carbon nanotube as hole-selective contact for high-efficiency full-area GaAs hybrid heterojunction solar cells

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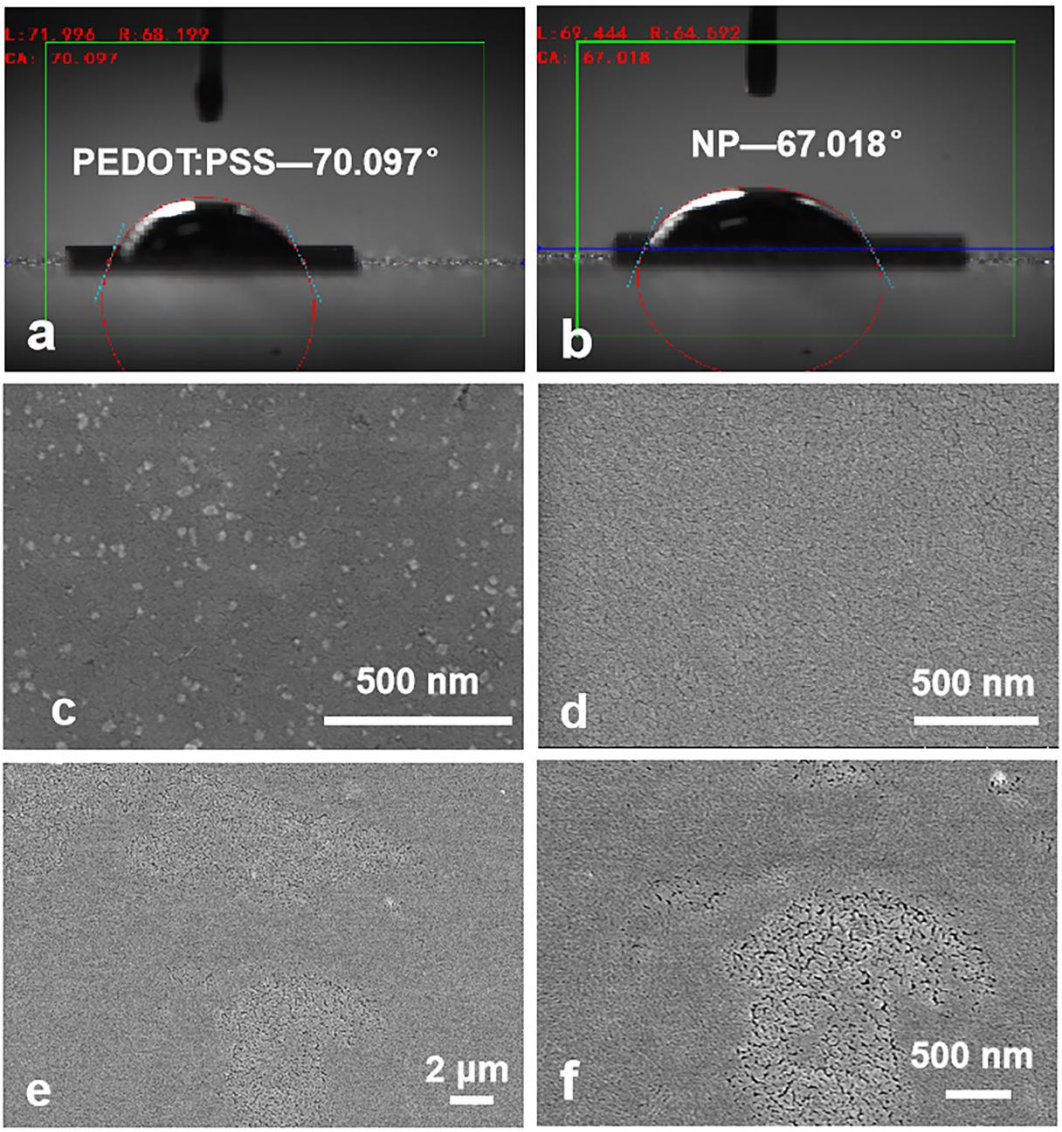

Fig. S1. The contact angles of (a) PEDOT:PSS and (b) NP0.05 film. The SEM images of (c) PEDOT:PSS, (d) NPCNT0.05, (e, f) NPCNT0.1 film.

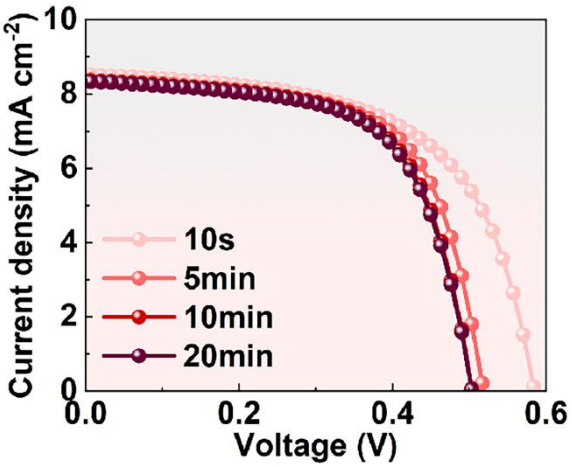

Fig. S2. The J-V characteristics of GaAs/NP HJSCs with different annealing times.

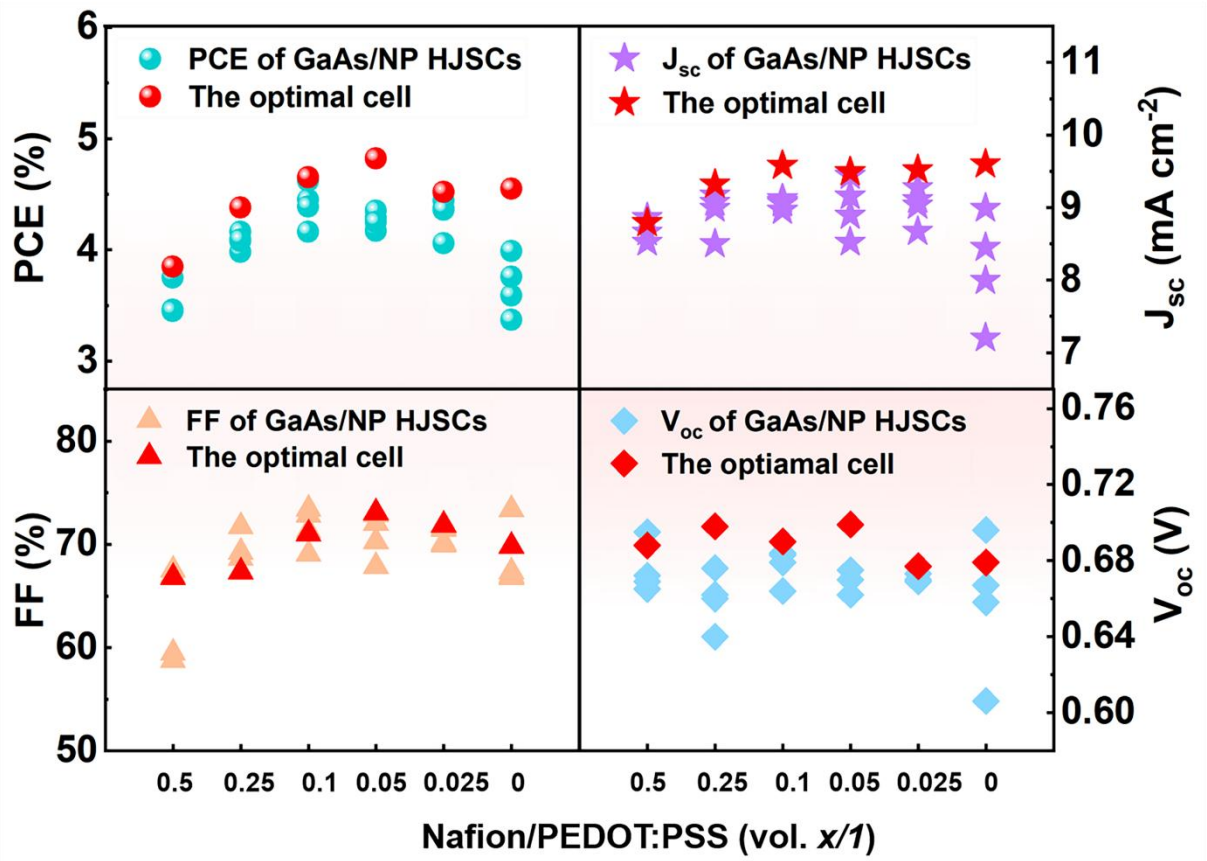

Fig. S3. The J-V characteristics of HJSCs with different ratio of Nafion and PEDOT:PSS.

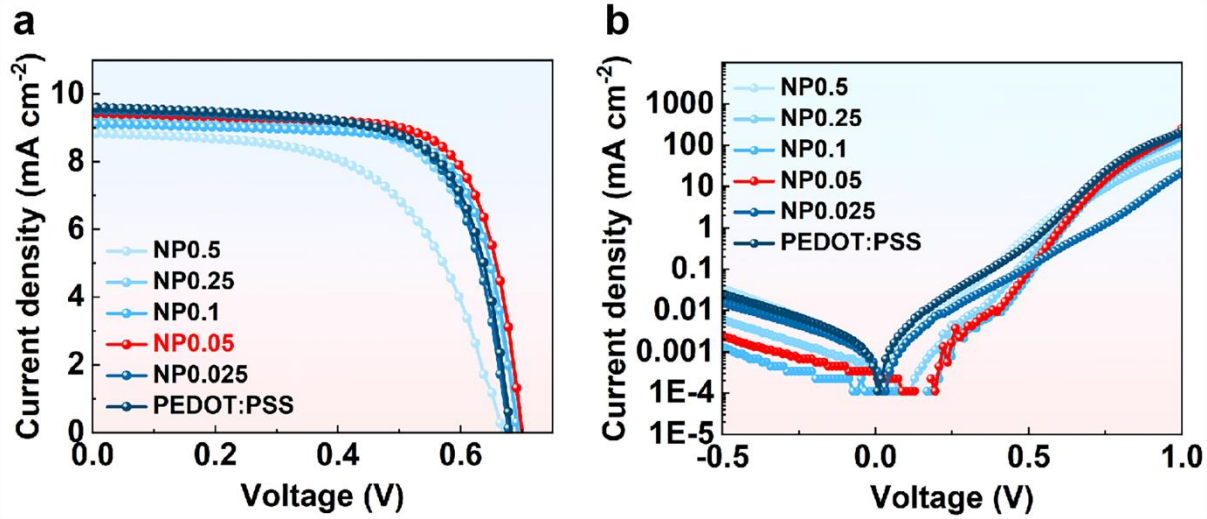

Fig. S4. The J-V characteristics of HJSCs with different ratio of Nafion and PEDOT:PSS under (a) illumination and (b) dark condition.

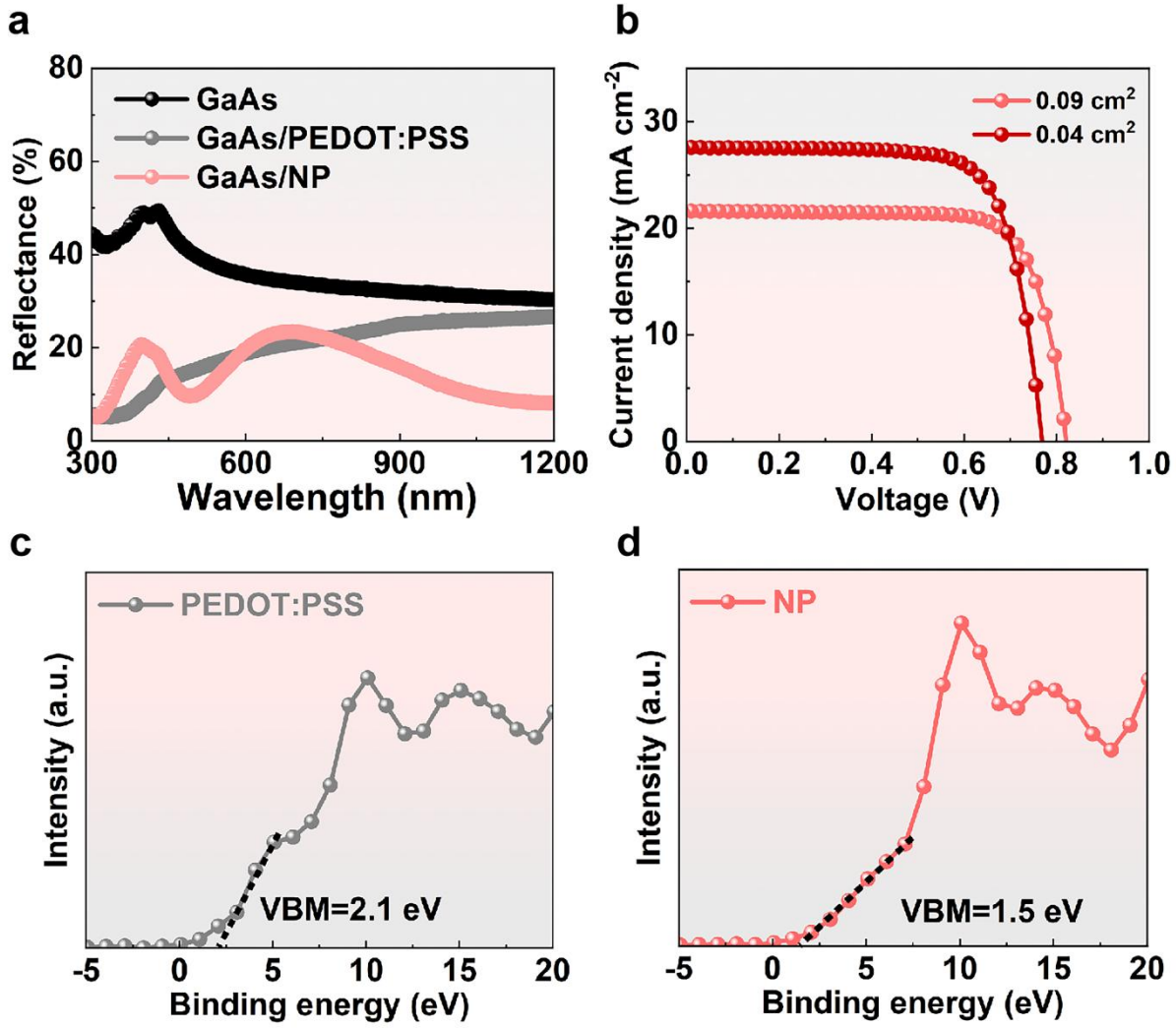

Fig. S5. (a) Reflectance spectra of the GaAs, GaAs/PEDOT:PSS and GaAs/NP. (b) J-V curves of GaAs/NP HJSCs with different active area. Valence band spectra of (c) PEDOT:PSS and (d) NP film.

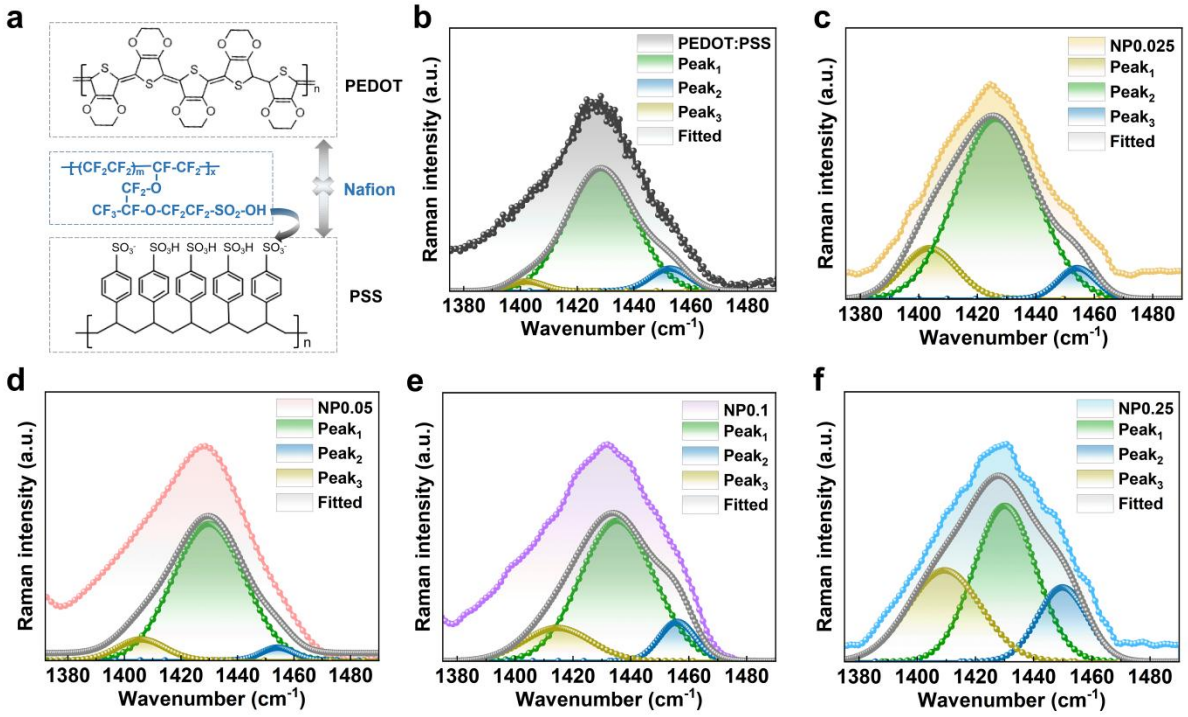

Fig. S6. (a) Chemical structures and the possible bonding interaction between PEDOT:PSS and Nafion. Raman analysis of C_α=C_β symmetric vibration peak for (b) PEDOT:PSS, (c) NP0.025, (d) NP0.5, (e) NP0.1 and (f) NP0.25 films.

Table S1 Integrated intensity ratios for the Raman spectra of NP films with different ratio of Nafion and PEDOT:PSS

Sample	Intensity of Benzoid peak (I_b)	Intensity of Quinoid peak (I_q)	I_b/I_{total}	I_q/I_{total}	I_b/I_q
PEDOT:PSS	256.29	1400.86	0.16	0.84	0.18
NP0.025	31.83	186.10	0.15	0.85	0.17
NP0.05	85.90	916.28	0.09	0.91	0.09
NP0.1	36.57	130.76	0.22	0.78	0.28
NP0.25	22.0	46.17	0.32	0.68	0.48

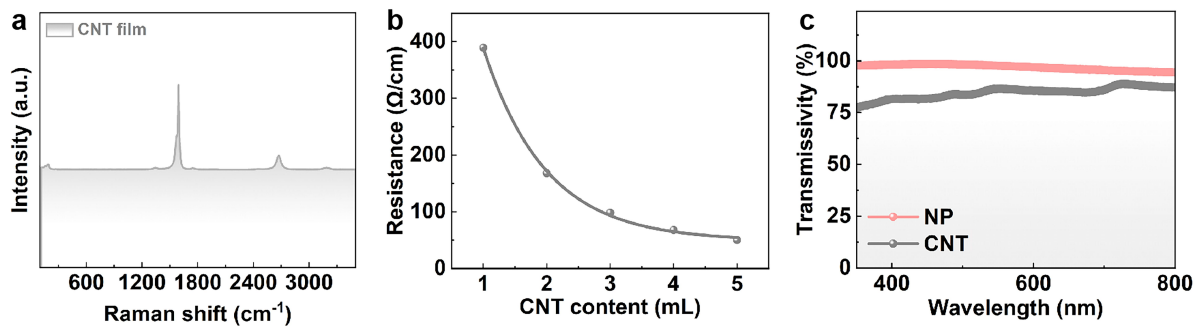

Fig. S7. (a) Raman spectra and (b) resistance versus content of CNT film. (c) Transmissivity spectra of the NP and CNT film.

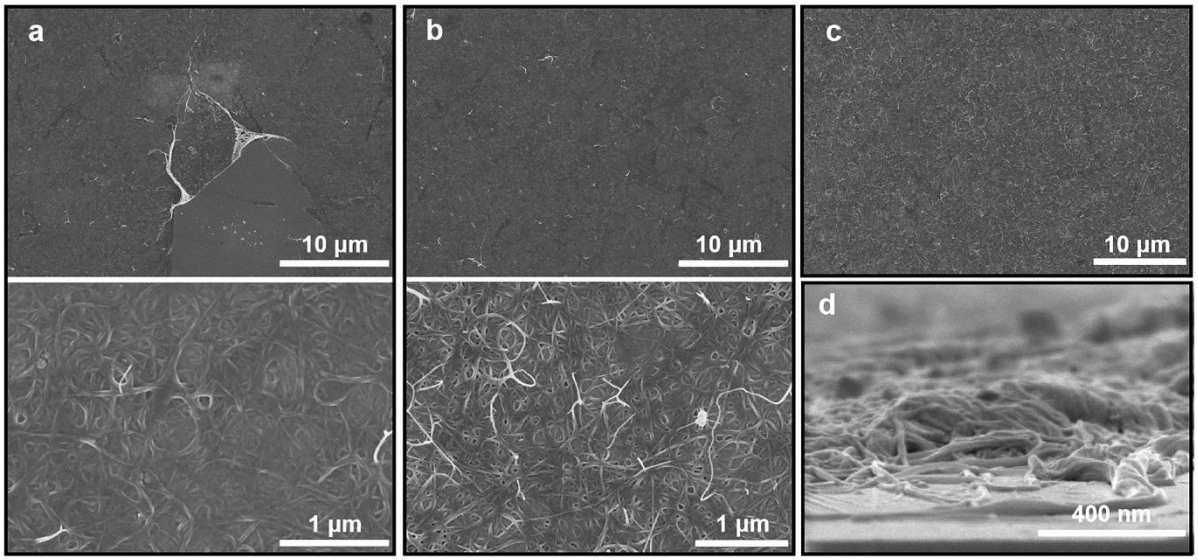

Fig. S8. SEM images of (a) CNT-0.25 mL, (b) CNT-1 mL and (c) CNT-1.5 mL. (d) The cross-sectional SEM image of CNT film.

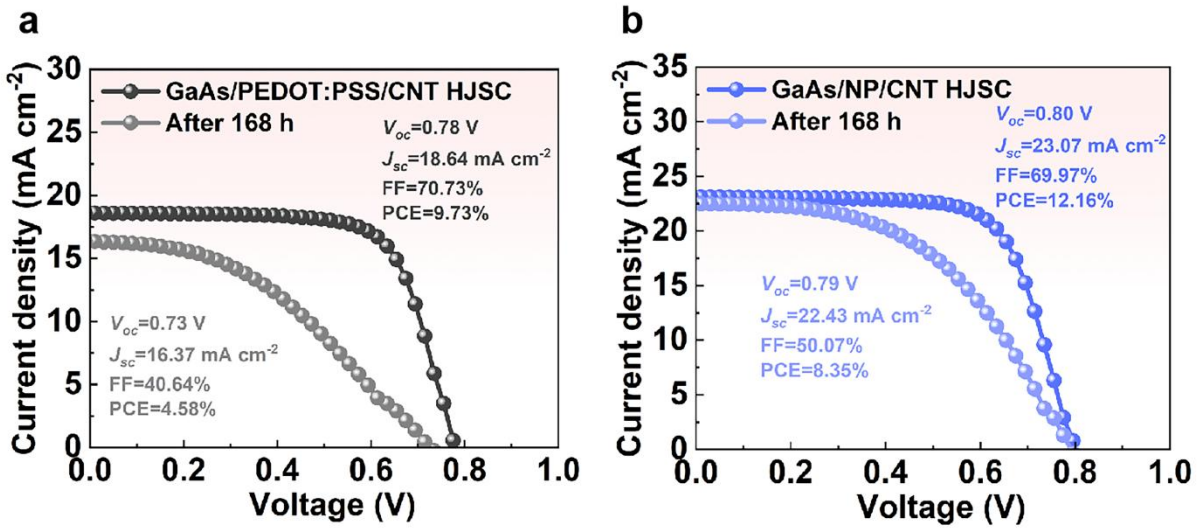

Fig. S9. The J-V characteristics of GaAs/PEDOT:PSS/CNT and GaAs/NP/CNT HJSCs with different ratio of Nafion and PEDOT:PSS at different working period.