# Supporting Information

**High-performance N-type Carbon Nanotubes Composites: Improved Power Factor by Optimizing the Acridine Scaffold and Tailoring the Side Chains**

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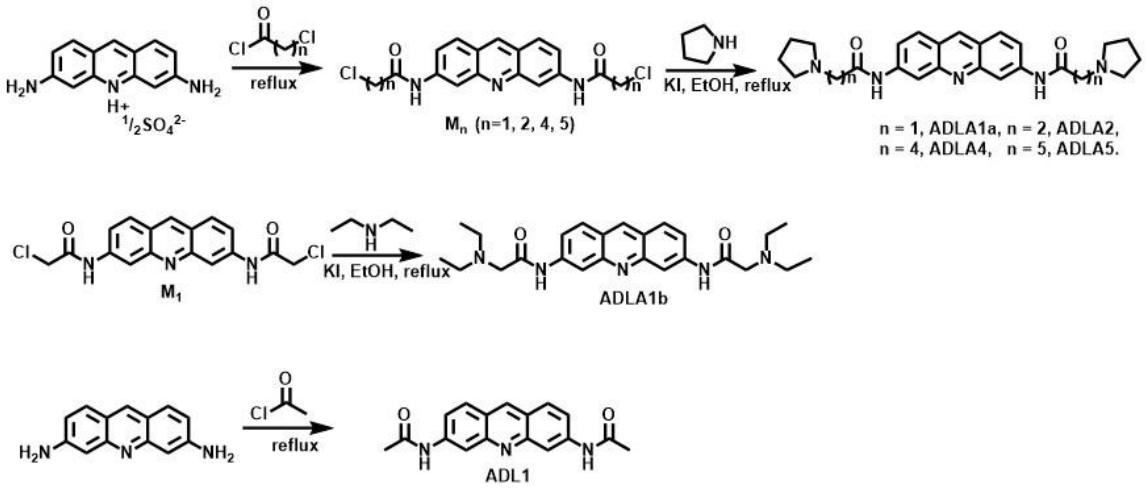


**Scheme S1.** Synthesis of acridine derivatives.

**Preparation of AD, AD-F, AD-Cl and ADLA4-F:**

To a solution of proflavine (AD-$SO_4$, 3 g, 15.34 mmol) in methanol (10 mL), NaOH (1 mol/L, 5 mL) was added with rapid stirring for 10 min. Yellow solids were filtered, washed with EtOH and ether, and then dried under vacuum to give AD.

To a suspension of AD (500 mg, 2.4 mmol) in methanol (5 mL), HF (5 μL) or HCl (500 μL) was added with rapid stirring for 30 min. Yellow solids were obtained after evaporation under reduced pressure, which were then further dried under vacuum to achieve AD-F and AD-Cl, respectively.

To a suspension of ADLA4 (510 mg, 1 mmol) in methanol (5 mL), HF (2 μL) was added with stirring for 30 min. Yellow solids were obtained after evaporation under reduced pressure, which were then further dried under vacuum to achieve ADLA4-F.

**Preparation of ADL1**

A solution of proflavine (1 g, 4.78 mmol) in acetyl chloride (5 mL) was refluxed for 2 h, and then cooled to 0 °C. The solids were filtered, washed with EtOH and ether, and then

recrystallized from DMF-EtOH (5:1 v/v) to give the ADL1 as a yellow solid. $^{1}$H NMR (400 MHz, DMSO-$d_6$) δ 10.32 (s, 2H), 8.80 (s, 1H), 8.45 (s, 2H), 8.00 (m, 2H), 7.58 (m, 2H), 3.13 (s, 6H). $^{13}$C NMR (101 MHz, DMSO-$d_6$) δ 169.55, 150.28, 141.21, 135.55, 129.54, 122.87, 120.55, 40.45, 40.04, 39.62, 24.78.

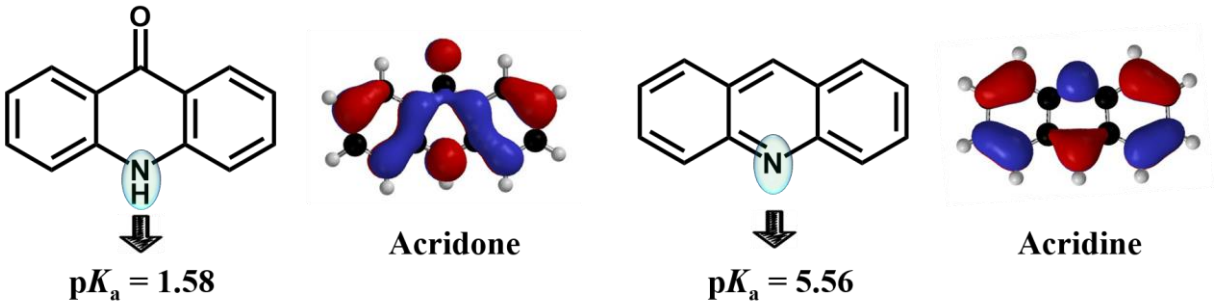


**Figure S1.** The scaffolds and their p$K_a$ values of acridone and acridine.

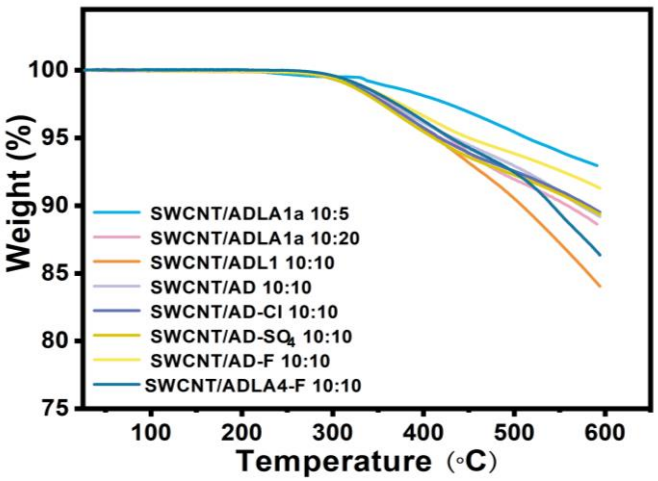


**Figure S2.** TGA curves of composite films.

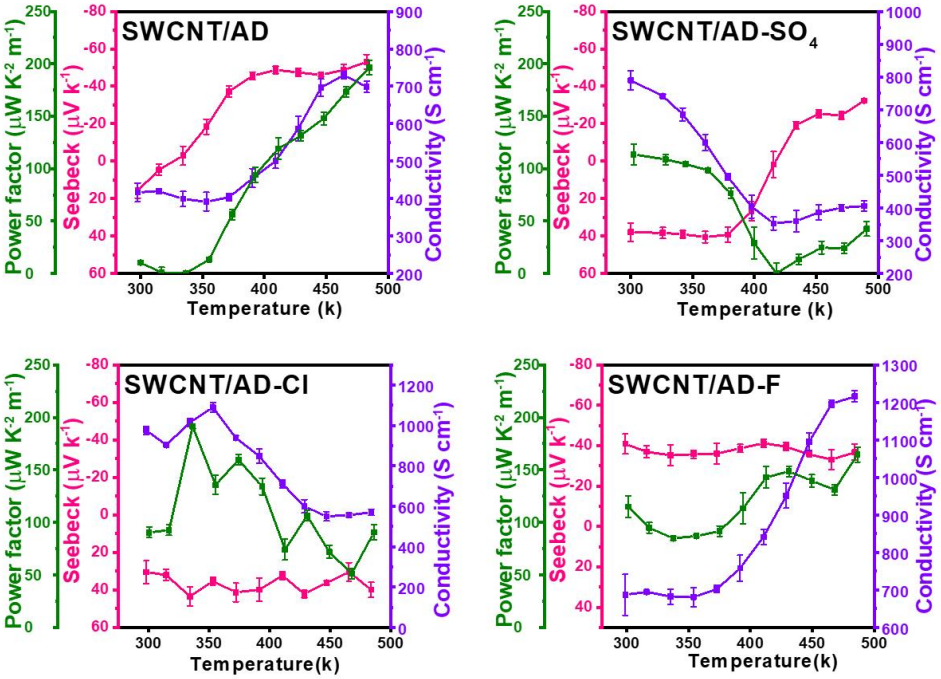


**Figure S3.** Temperature (T) dependence of the TE performance of SWCNT/AD-$SO_4$, SWCNT/AD-Cl, SWCNT/AD and SWCNT/AD-F.

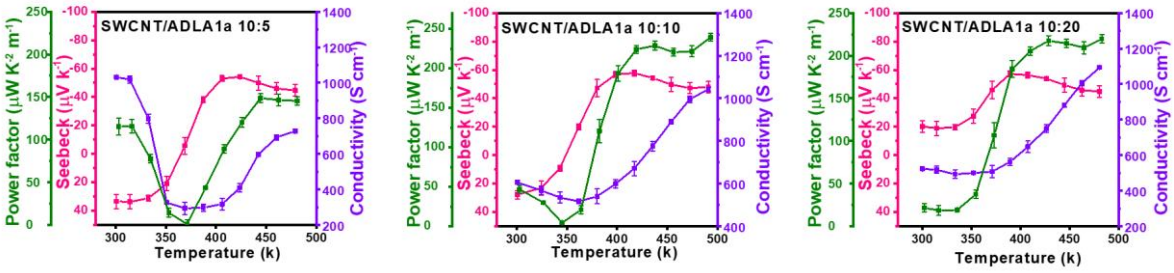


**Figure S4.** Temperature (T) dependence of the TE performance of SWCNT/ADLA1a with different mass ratios (10:5, 10:10 and 10:20).

**Table S1.** The TE performance of SWCNTs and SWCNT/ADLA4 composite films at 300 K.

| | $\rho$ [g $cm^{-3}$] | $Cp$ [J $g^{-1}$ $K^{-1}$] | $\alpha$ [$m^2$ $s^{-1}$] | $\kappa$ [W $m^{-1}$ $K^{-1}$] | ZT |
|---|---|---|---|---|---|
| **SWCNT/ ADLA4** | 0.418 | 1.65 | $1.46\times10^{-5}$ | 9.76 | $6.00\times10^{-3}$ |
| **pure SWCNTs** | 0.456 | 1.45 | $1.11\times10^{-5}$ | 7.36 | $4.45\times10^{-3}$ |

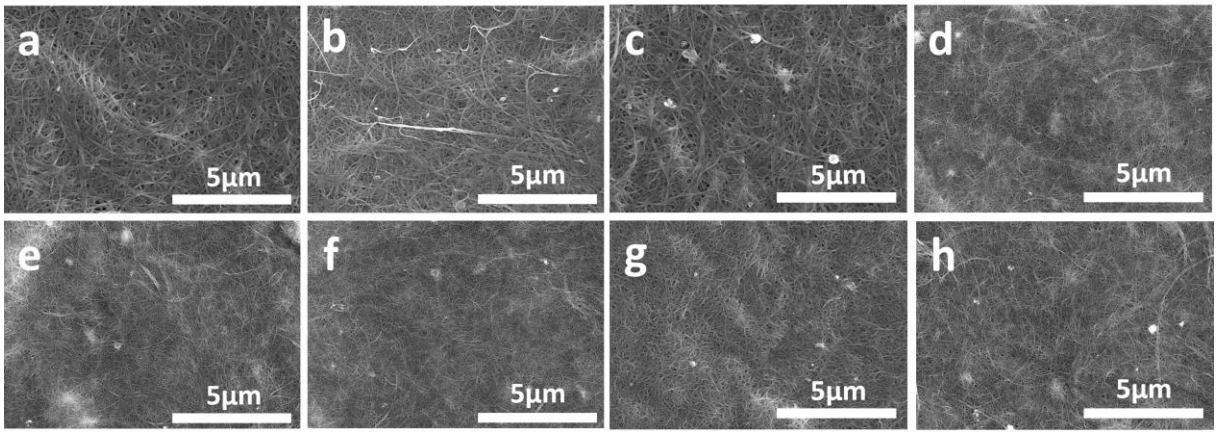


**Figure S5.** SEM images of composite films a-c) SWCNT/ADLA1a with different mass ratio, a) 10:5, b) 10:10, c) 10:20, d) SWCNT/AD, e) SWCNT/AD-SO4, f) SWCNT/AD-F, g) SWCNT/AD-Cl, h) SWCNT/ADLA4-F. The mass ratio of SWCNTs and OSMs of d-h) was 10:10.

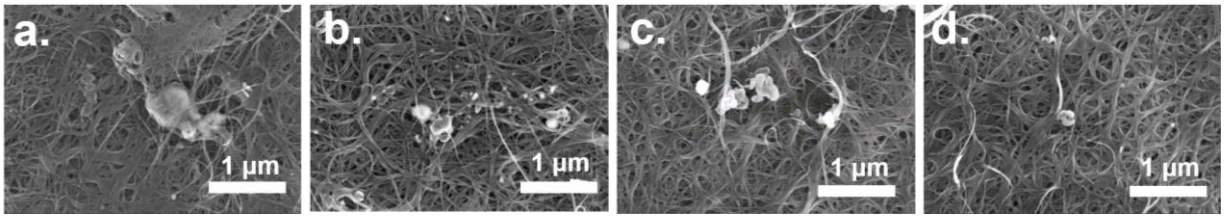


**Figure S6.** SEM images of composite films with 1:1 mass ratio. a) SWCNT/AD, b) SWCNT/AD-F, c) SWCNT/AD-$SO_4$ and d) SWCNT/AD-Cl.

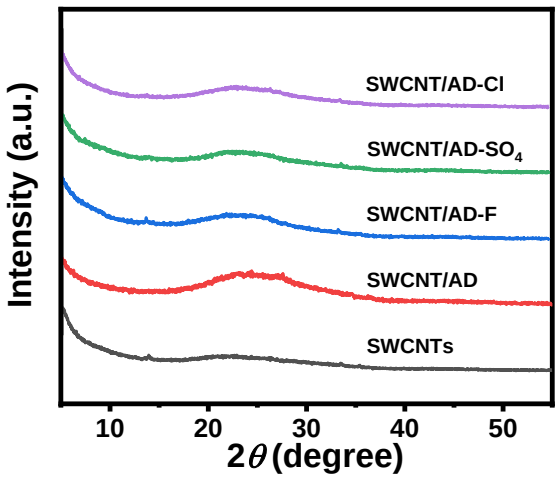

**Figure S7.** XRD patterns of SWCNTs, SWCNT/AD, SWCNT/AD-F, SWCNT/AD-$SO_4$ and SWCNT/AD-Cl films.

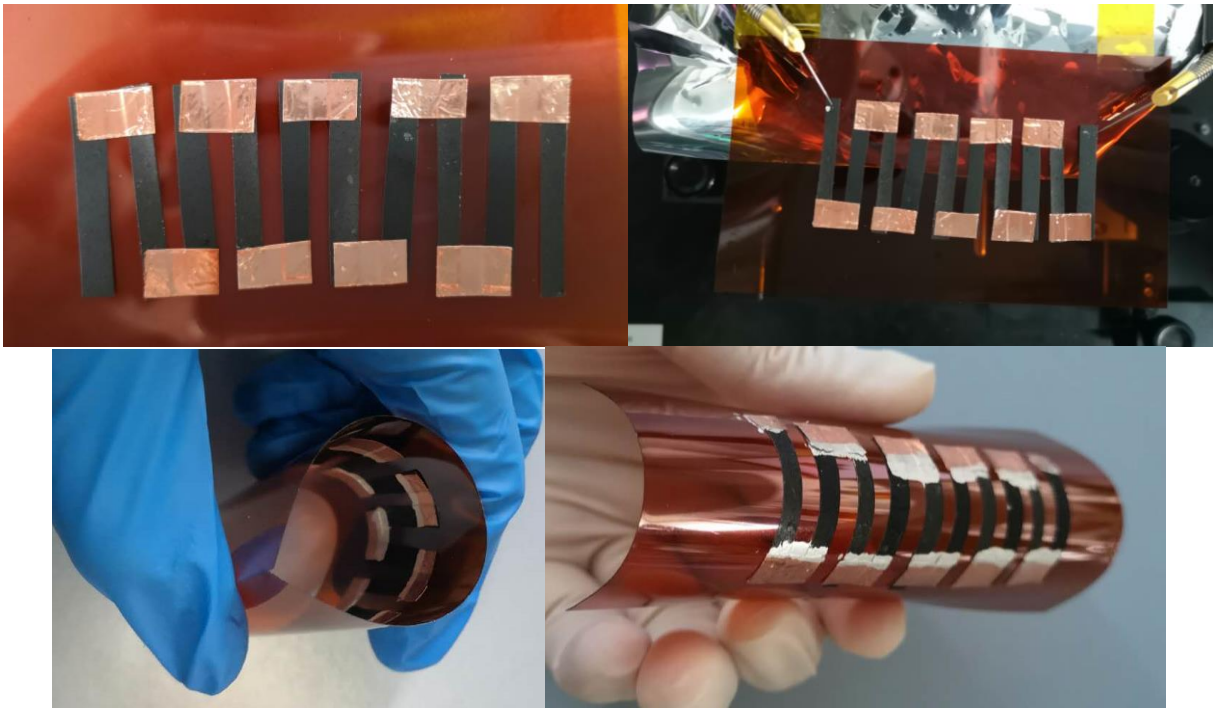

**Figure S8.** Photographs of the TE module assembled, probe station and bending.