Supporting information for:

High-performance n-type thermoelectric composites of acridones with tethered tertiary amines and carbon nanotubes

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Measurements of thermal conductivities.

The parallel thermal conductance method originally proposed by Zawilski , Littleton and Tritt[1] was adapted here to measure the in-plane thermal conductivity of the composite films (around 3 mm × 1.5 mm × 80 μm). The sample holder consists of a strain-gauge heater (R=350 Ohm) and a copper heat sink. A Kapton stripe which has a low thermal conductivity was used to connect the heater and the heat sink. (Figure s1 a) The film sample was attached to the sample holder with silver paste. (Figure s1b) Two T-type thermocouples were employed to monitor the temperature at the hot side and the cold side of the sample, respectively. The sample holder was surrounded by a radiation shield to reduce radiation losses. The whole assembly was placed in a vacuum chamber at 10^{-4} Pa. The total thermal conductance C_{Total} of the sample and the sample holder was conducted by applying multiple DC heating current s (I's) to the heater and generating corresponding steady temperature differences (ΔT's) across the sample. Heating power (P) varies linearly with ΔT as denoted by the following equation:

$$P= I^2 R=C_{Total}\Delta T \qquad (1).$$

C_{Total} was then extracted from linear fit of the P ~ΔT plot.

Later, the sample was cut from the middle and the baseline thermal conductance $C_{Baseline}$ of the setup was determined in a similar way:

$$P = I^2 R = C_{Baseline}\Delta T \qquad (2).$$

The thermal conductivity κ of the sample is obtained from the following equation:

$$\kappa = (C_{Total}-C_{Baseline})L/A \qquad (3).$$

where L and A are length and cross-sectional area of the sample, respectively.

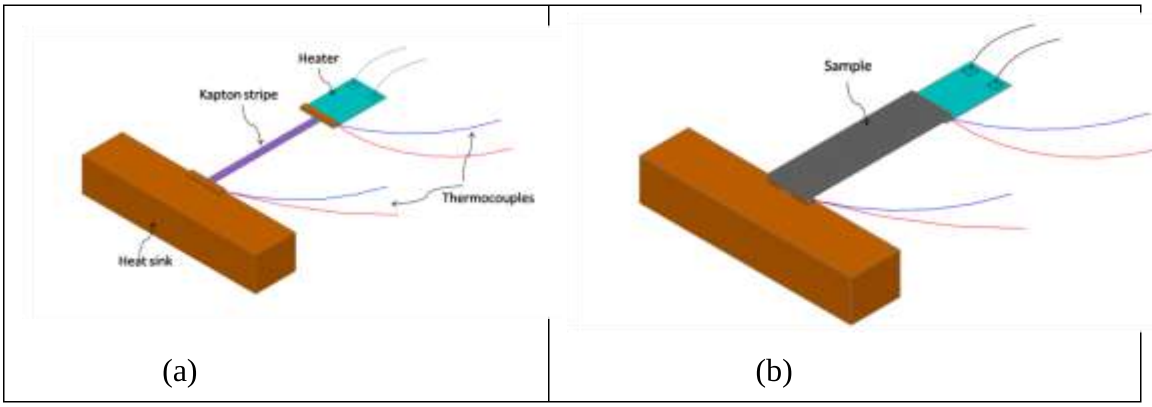
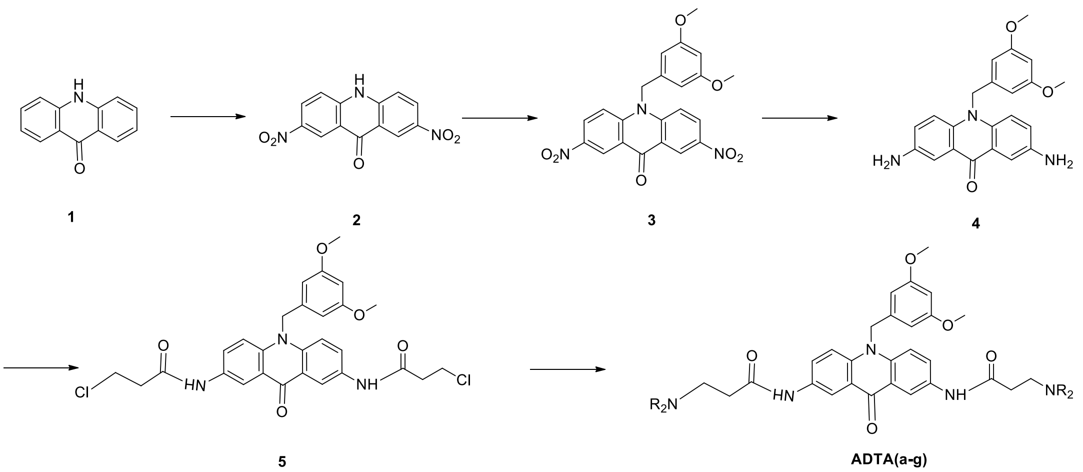


Figure S1 (a) Configuration of the sample holder for measuring in-plane thermal conductivity; (b) The sample holder mounted with a sample.



Scheme S1. Synthesis of acridone derivatives ADTA(a-g)

Table S1 Carrier concentration and carrier mobility of SWCNT/ADTA(b-e) composite films.

films	SWCNT/ ADTAb	SWCNT/ ADTAc	SWCNT/ ADTAd	SWCNT/ ADTAe
n [cm^{-3}]	6.81×10^{20}	4.92×10^{20}	4.47×10^{21}	2.19×10^{20}
μ [cm^{2}/Vs]	8.57	8.87	1.12	13.64
σ [S m^{-1}]	64242.3	28599.4	52795.6	45397.9

Table S2 The TE performance of SWCNT, SWCNT/ADTAb, and SWCNT/ADTAd films at 298 K.

films	SWCNT/ ADTAb	SWCNT/ ADTAd	SWCNT
k [W m^{-1} K^{-1}]	8.3 ± 1.0	11.0 ± 1.5	12.9 ± 2.0
PF [μW m^{-1} K^{-2}]	124.4	39.8	103.4
ZT	$4.5\text{x}10^{-3}$	$1.1\text{x}10^{-3}$	$2.4\text{x}10^{-3}$

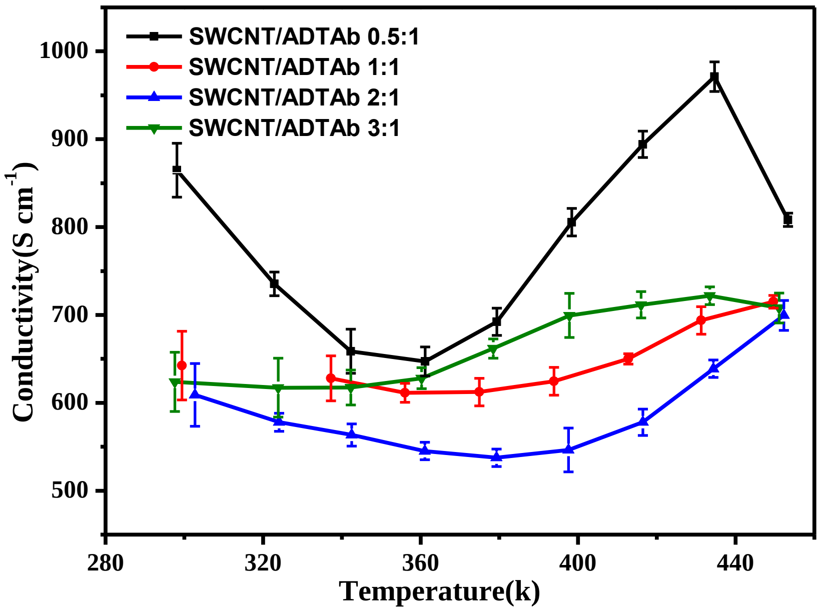


Figure S2 *σ versus T* for SWCNT/ADTAb films with different mass ratios.

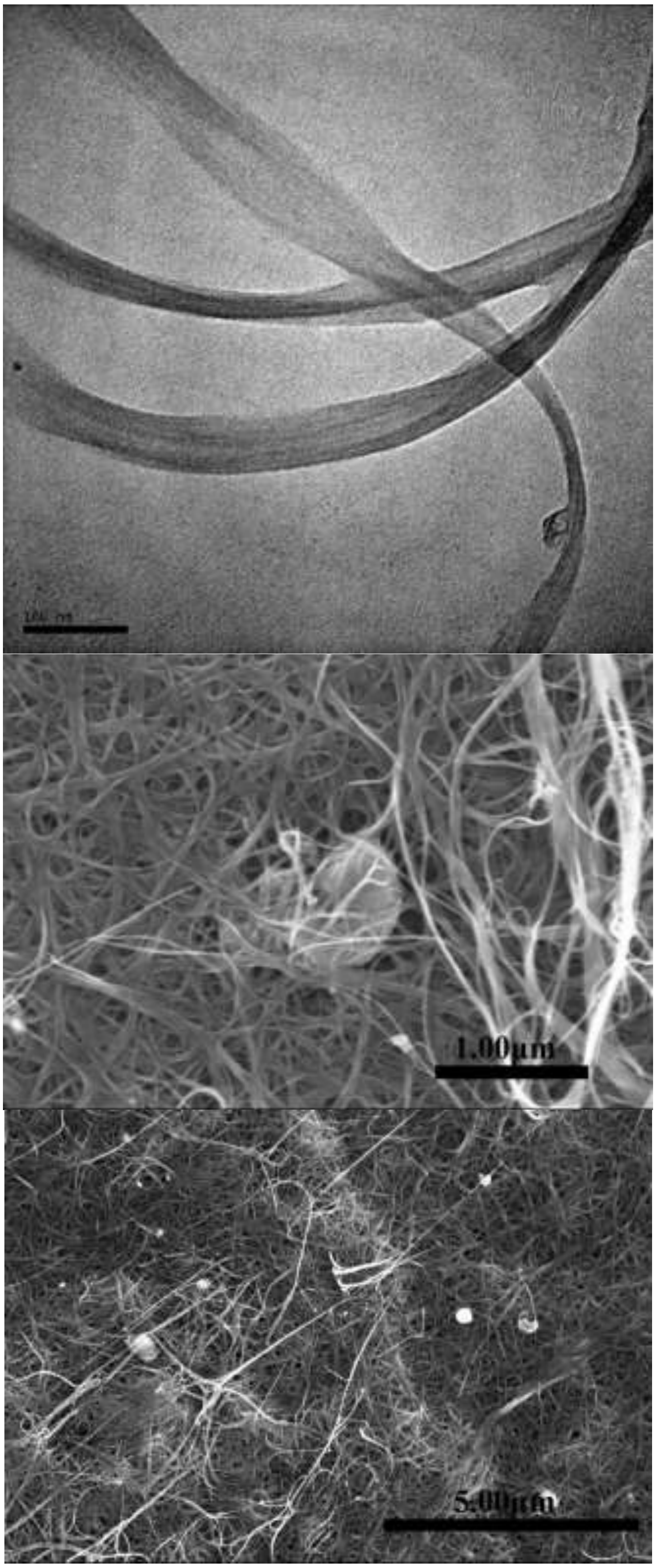


Figure S3 SEM images of the surfaces of SWCNT/ADTAb with different magnification scales.

Reference

1. Zawilski, B. M., Littleton R.T. and Tritt T. M., Description of the parallel thermal conductance technique for the measurement of the thermal conductivity of small diameter samples. *Rev. Sci. Instrum.*, 2001, 72, 1770–1774.