

Supplementary information

Carbon nanotube-induced migration of silver nanowire networks into plastic substrates for high stability

Jong Seok Woo^{1,2}, Byung Kuk Kim¹, Ho Young Kim¹, Geon-Woong Lee¹, Soo-Young Park² and

Joong Tark Han¹

¹Nano Hybrid Technology Research Center, Korea Electrotechnology Research Institute,
Changwon 641-120, Republic of Korea

²Department of Polymer Science & Engineering, Polymeric Nanomaterials Laboratory,
School of Applied Chemical Engineering, Kyungpook National University, #1370 Sangyuk-
dong, Buk-gu, Daegu 702-701, Republic of Korea

* Corresponding authors.

E-mail address: jthan@keri.re.kr (J. T. Han); psy@knu.ac.kr (S.-Y. Park)

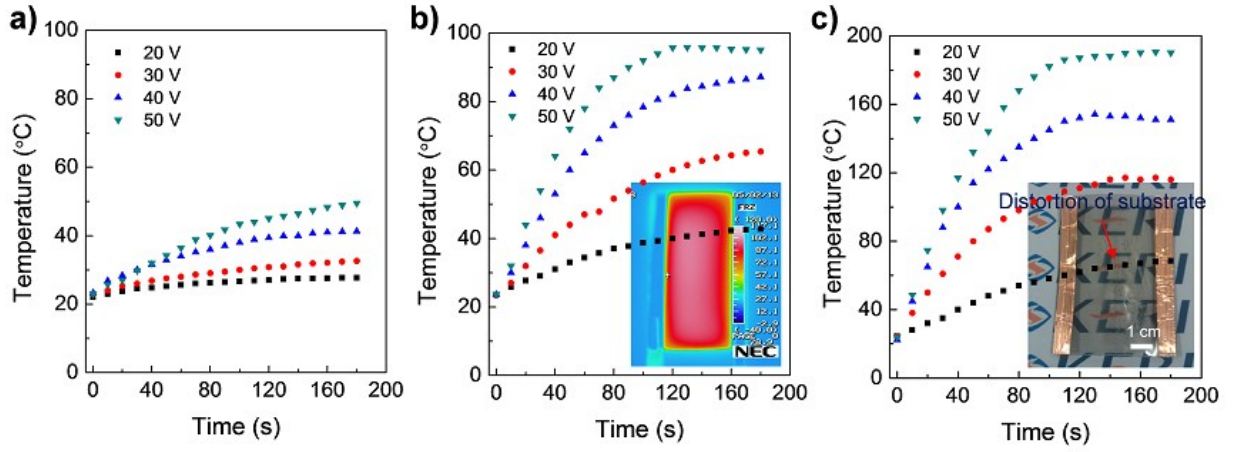


Fig. S1. Time versus temperature profiles at various applied DC voltages for SWCNTs with R_s of (a) 1000, (b) 250, and (c) 100 Ω/sq .

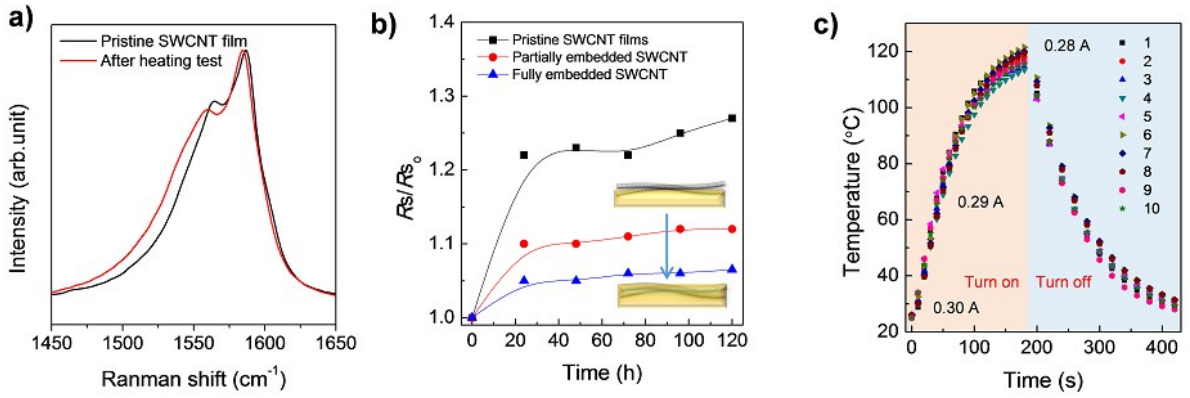


Fig. S2. (a) Raman spectra of the pristine SWCNT thin film and self-embedded SWCNT thin film after heating. (b) Hydrothermal stability of the pristine SWCNT and self-embedded SWCNT thin films (conditions: 80 $^{\circ}\text{C}$; 80% relative humidity). (c) Cycle test of the SWCNT heater ($R_s = 100 \Omega/\text{sq}$; 30 V).

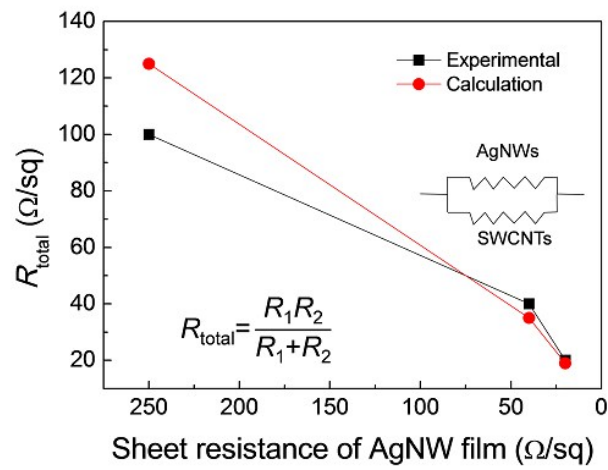


Fig. S3. Change in R_s in the parallel-resistor circuit model after over-coating SWCNTs on the AgNW networks. R_1 : R_s of the AgNW film, R_2 : R_s (250 Ω/sq) of the SWCNT film.

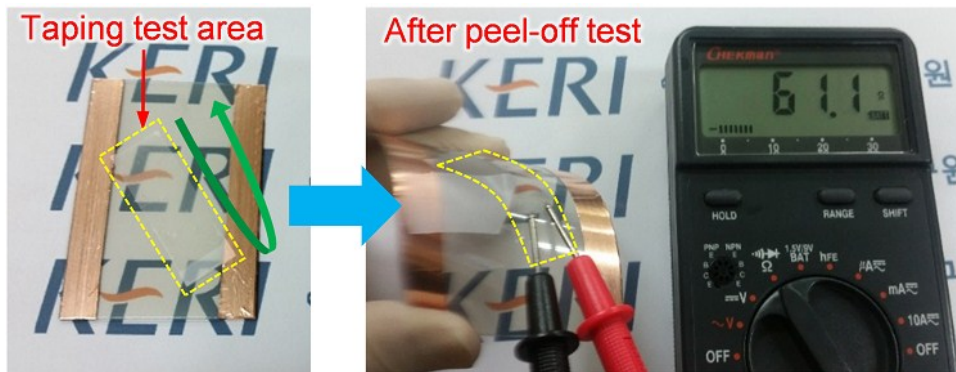


Fig. S4. Change in R_s after peel-off test of a flexible AgNW-SWCNT film on a PC substrate.

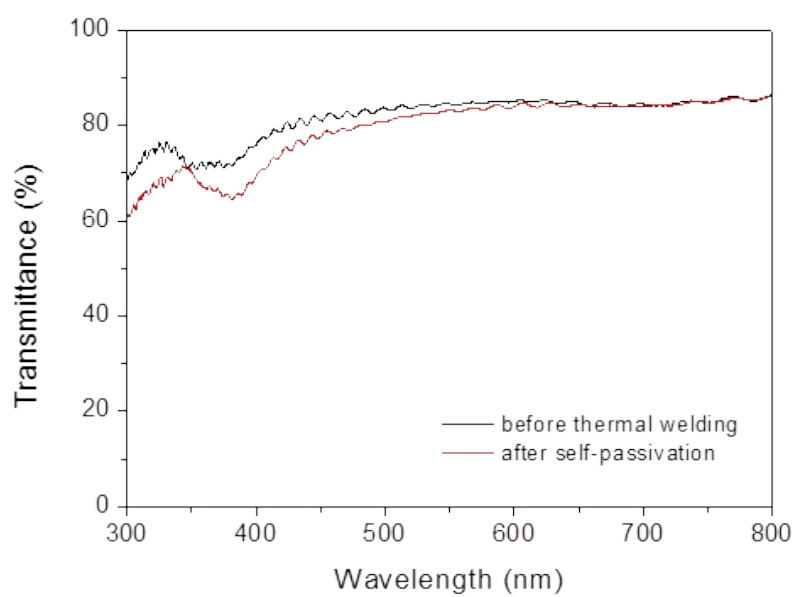


Fig. S4. The optical transmittance of the AgNW-SWCNT film before and after Joule heating.

Table S1. Power consumption of SWCNT and AgNW–SWCNT films.

Heater	Voltage (V)	Current (A)	Resistance (ohm/sq)	Power consumption (W) ^a
SWCNT thin film	30	0.03	1000	0.9
		0.067	450	2.0
		0.12	250	3.6
		0.30	100	9.0
AgNW–SWCNT thin film	40	0.4	100	16
	20	0.5	40	10
	15	0.75	20	11.25

^aThe power consumption was obtained from Joule's first law, $P = V^2/R$ (where P is the power dissipated in a resistive conductor, V is the applied voltage, and R is the total resistance).

Table S2. Peel-off test results at different R_s values under different applied voltages.

Heater	Resistance (ohm/sq)	Voltage (V)	Steady-state temp. (°C)	Peel-off test
SWCNT thin film	1000	50	42	Failure
	450		80	
	250		100	
	100	30	120	Partially
		40	160	OK
		50	190	
AgNW–SWCNT thin film	100	40	160	
	40	20	140	
	20	15	160	