

Supplementary Information

Laser Patterned, High-Power Graphene Paper Resistor with Dual Temperature Coefficient of Resistance

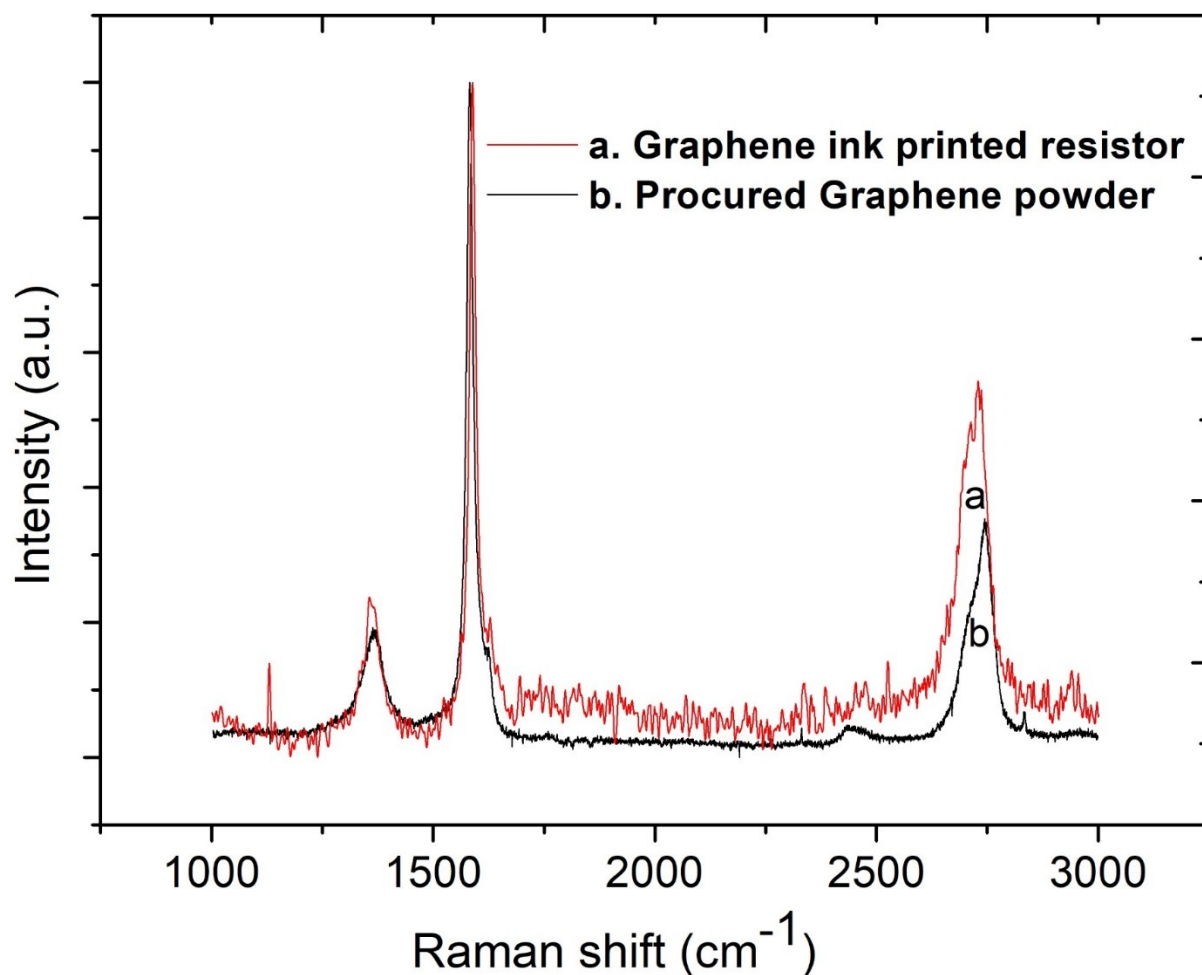


Figure S1: Raman spectra of Procured graphene powder and graphene ink printed resistor

Table S1: Change in resistance corresponding to the annealing temperature and time

Annealing Time (min.)	At 373K	At 423 K
	Change in Resistance per minute	
10	331	1761
30	88	47
60	13	44
120	55	4

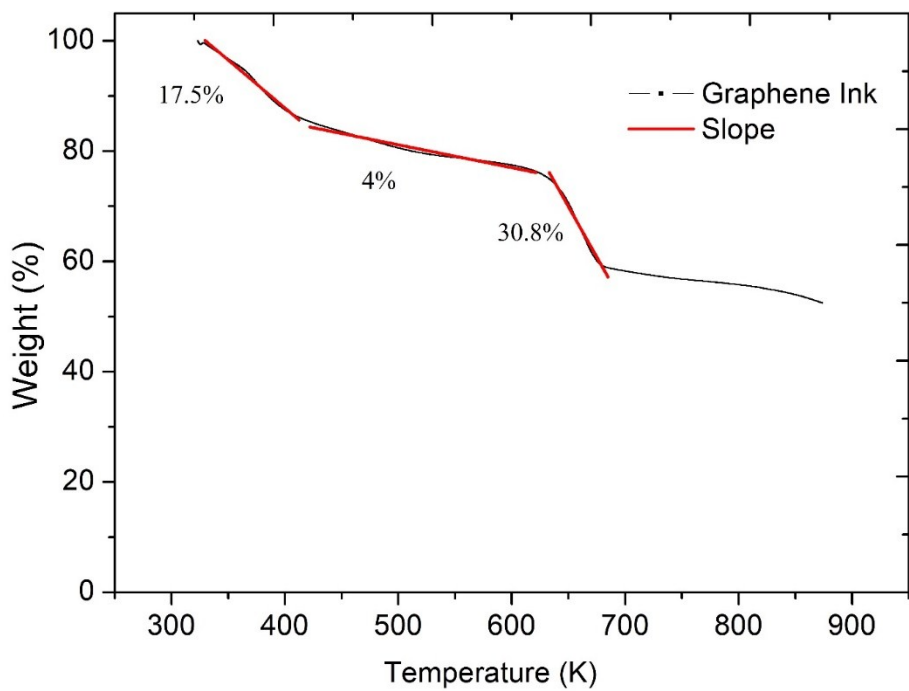


Figure S2: TGA of the graphene ink

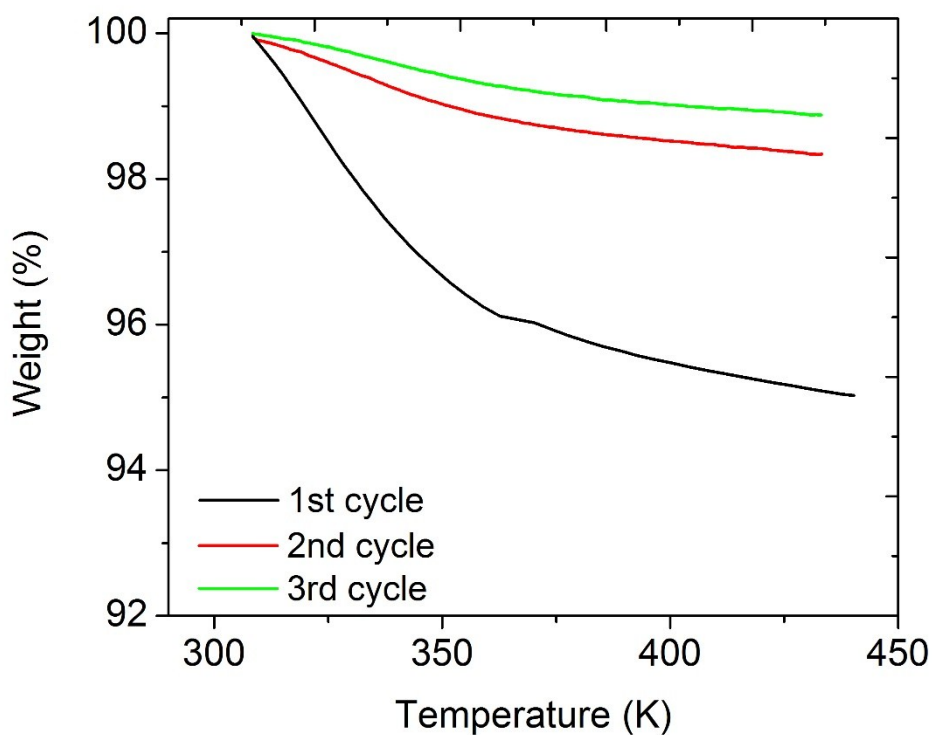


Figure S3: TGA of the graphene ink bar coated on paper



Figure S4: Cryostat setup for I-V characterization

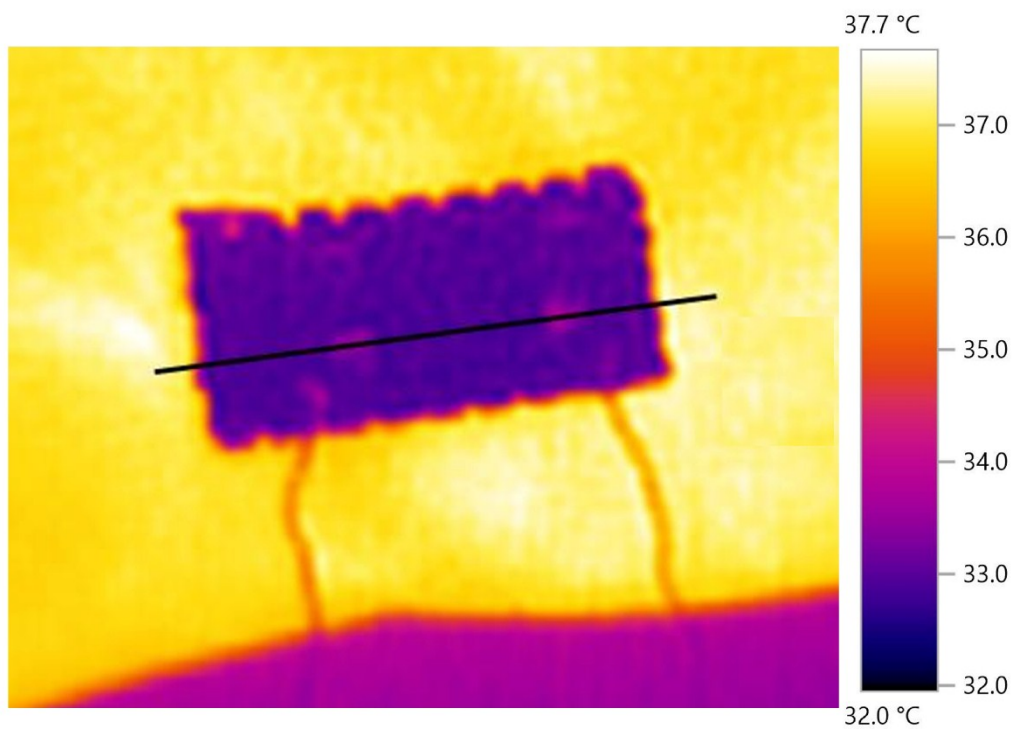


Figure S5: IR imaging of resistor after operating at 200V for 60 sec.

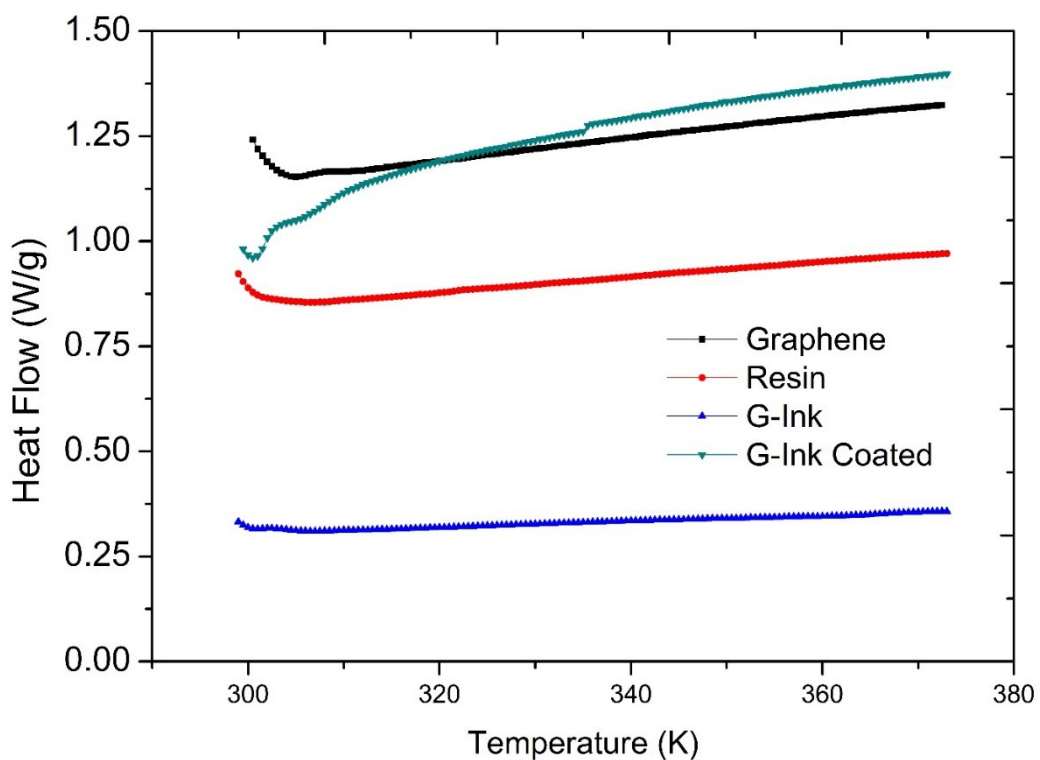


Figure S6: DSC profile of graphene, resin, graphene ink (G-Ink) and graphene ink coated on paper substrate

Table S2: Mean values along with standard deviation of TCR, thermal index and activation energy for variable annealing temperature and time

Parameters	Annealed at 373 K for 10 min		Annealed at 373 K for 120 min		Annealed at 423 K for 10 min		Annealed at 423 K for 120 min	
	Cold Region	Hot Region	Cold Region	Hot Region	Cold Region	Hot Region	Cold Region	Hot Region
-ve TCR (PPM/K)	750 ± 125	2100 ± 1000	850 ± 100	1480 ± 350	800 ± 150	2000 ± 400	700 ± 150	1100 ± 200
Thermal Index (K)	50 ± 10	190 ± 30	50 ± 2	125 ± 20	50 ± 5	230 ± 40	45 ± 6	150 ± 35
Activation Energy (meV)	8 ± 2	32 ± 5	9 ± 0.5	22 ± 4	9 ± 1	40 ± 6	8 ± 1	25 ± 6
Adj. R-Square	0.99	0.94	0.99	0.92	0.97	0.93	0.94	0.86

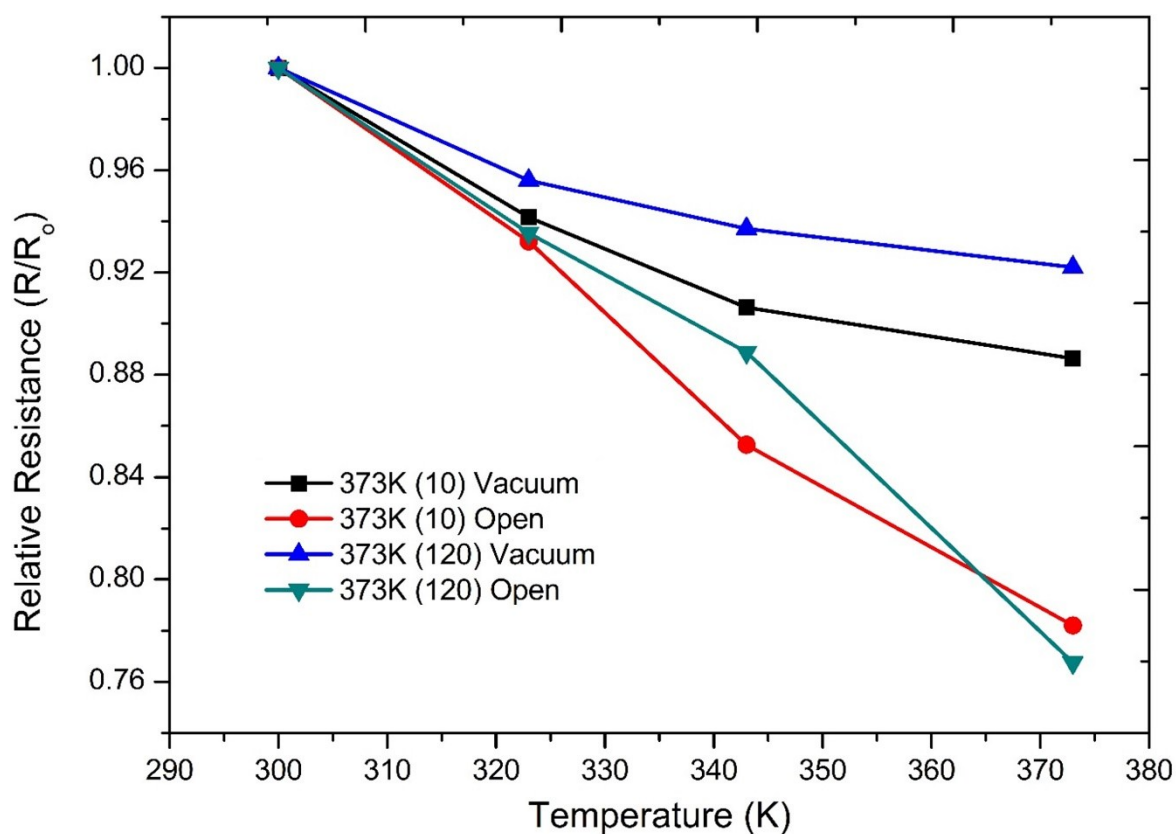


Figure S7: Change in relative resistance with temperature in vacuum and open for sample annealed at 373 K

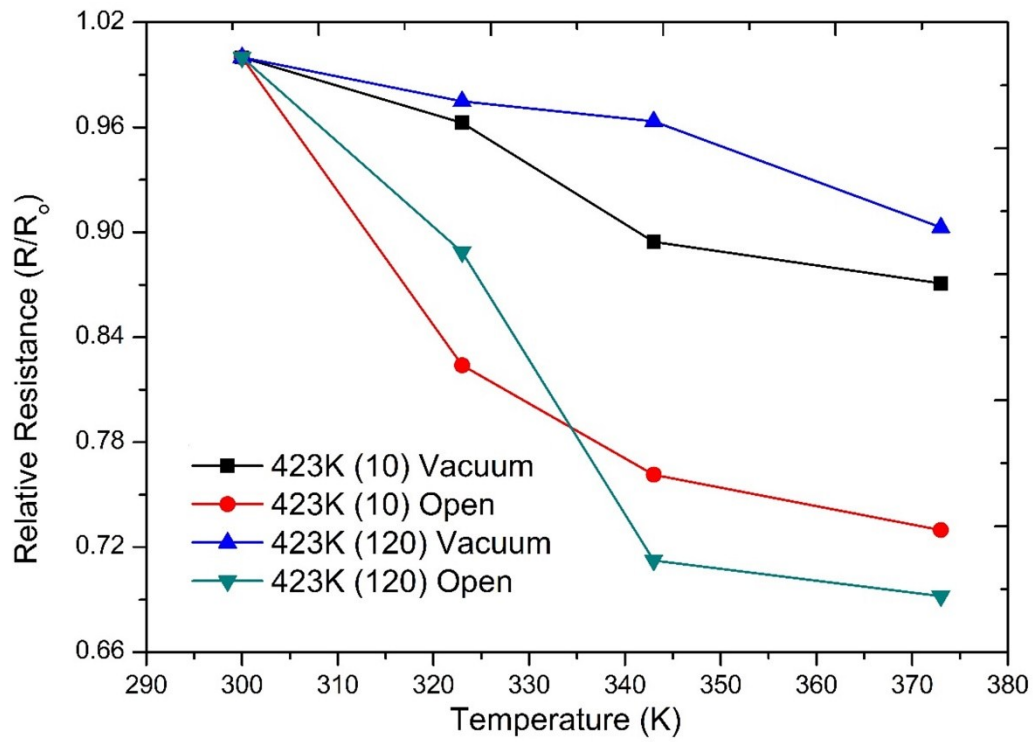


Figure S8: Change in relative resistance with temperature in vacuum and open for sample annealed at 423K