

## Supporting Information for

# Wool Fabrics Decorated with Carbon-based Conductive Ink for Low-Voltage Heaters

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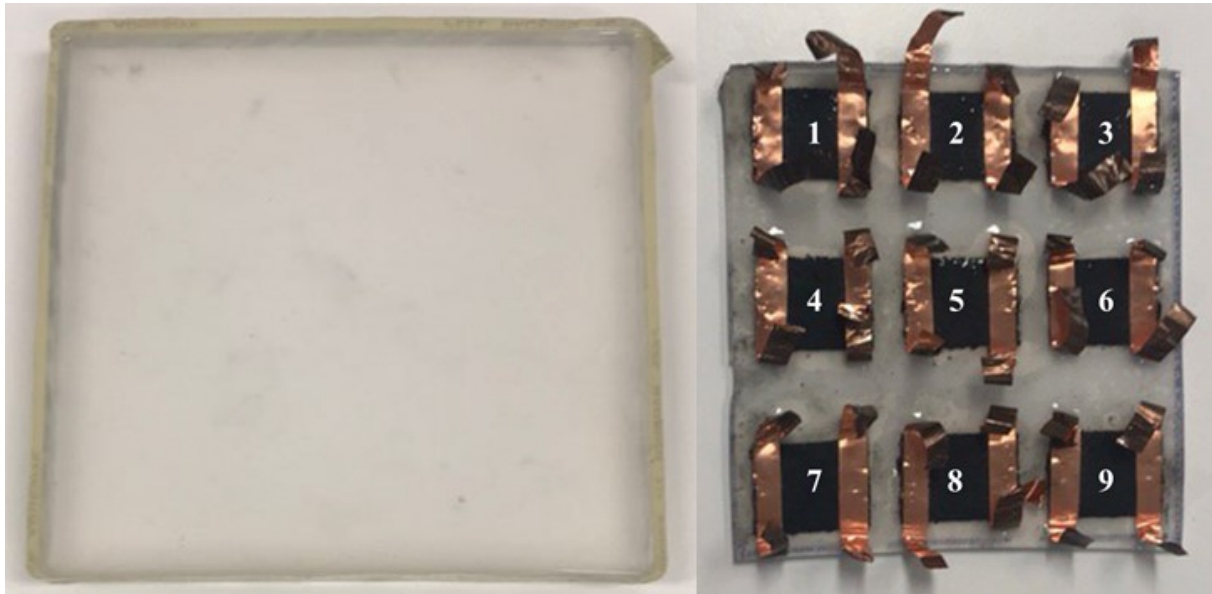
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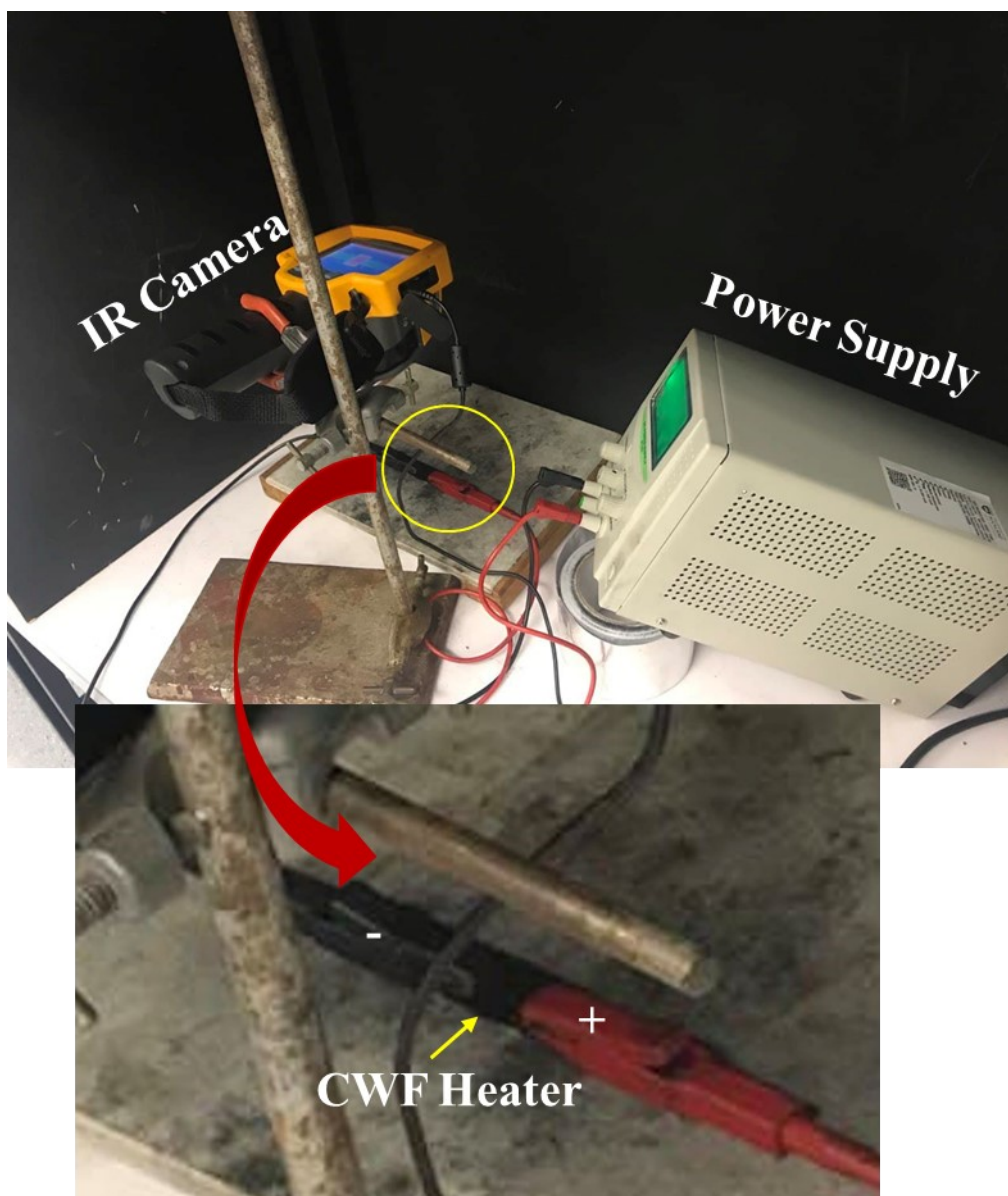
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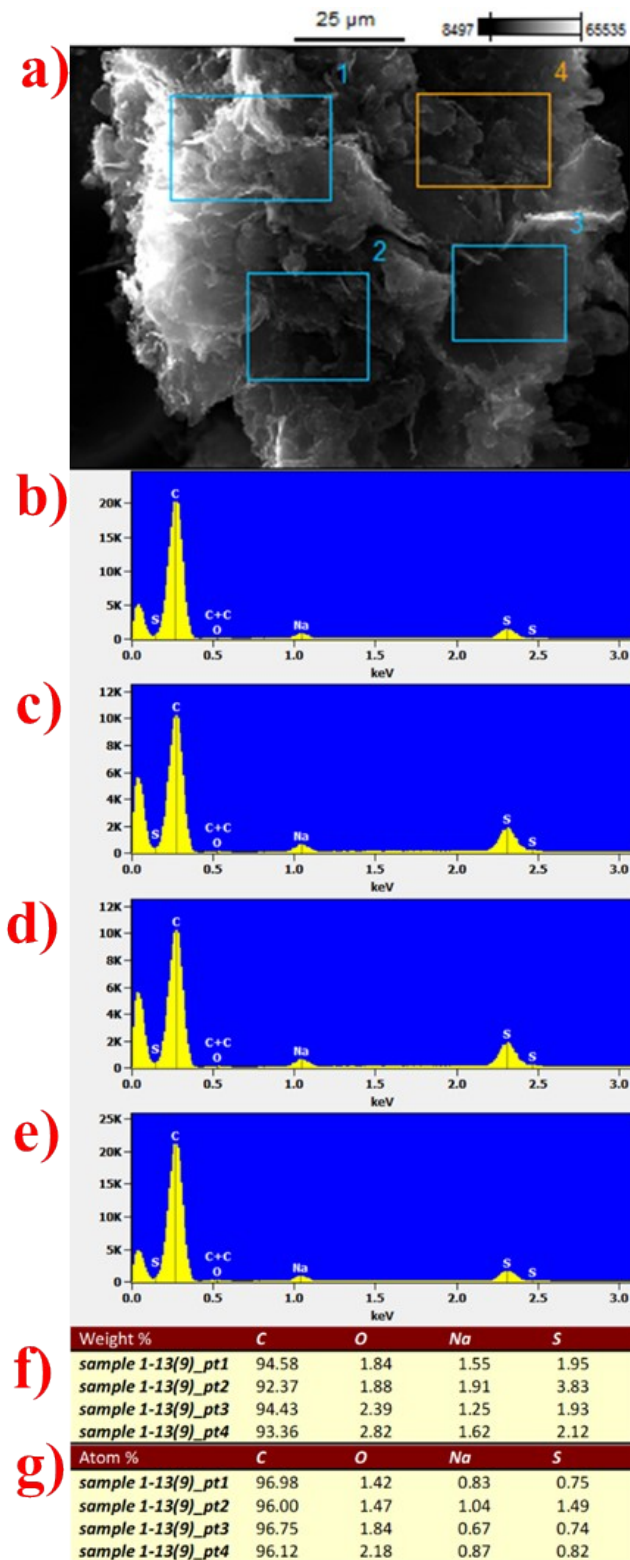
**Figures S1-S8, Table S1 and References**



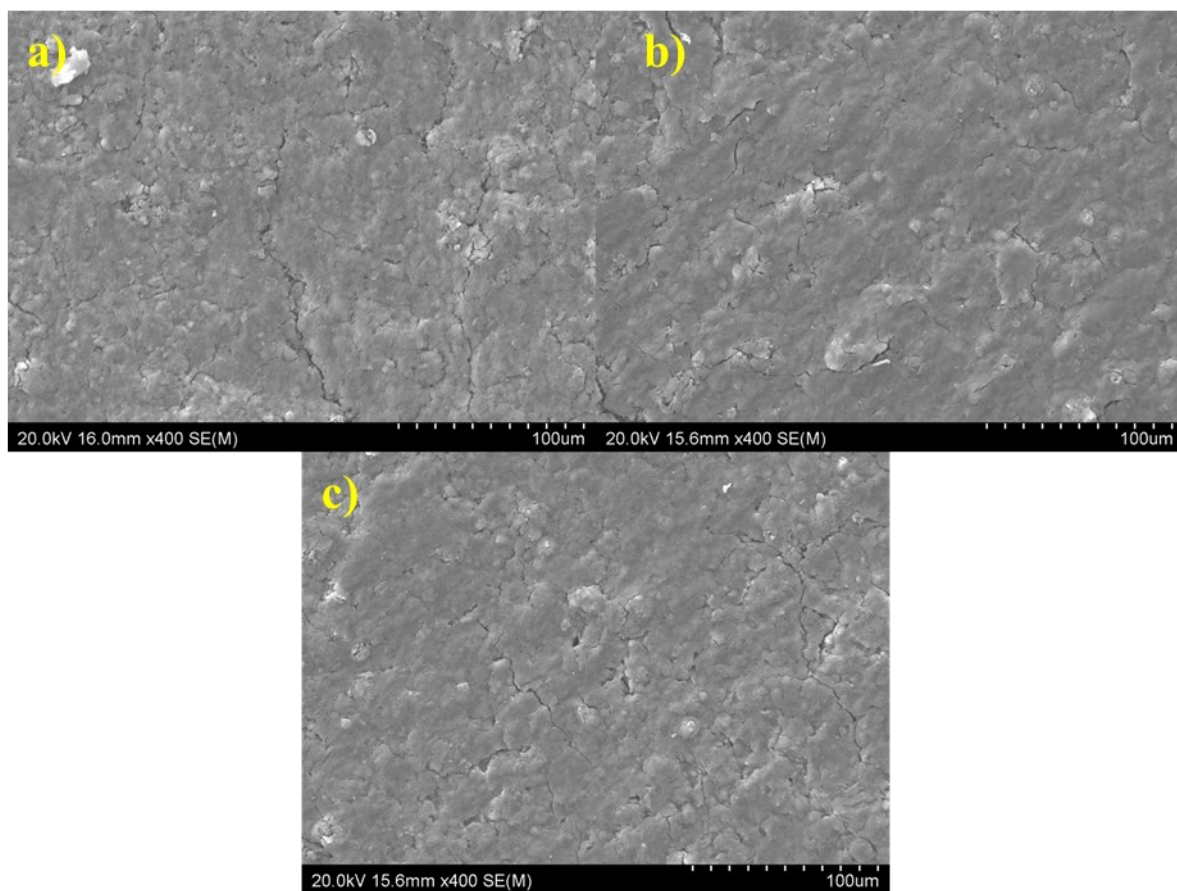
**Figure S1.** View of the substrate and the concept of a large size heating device.



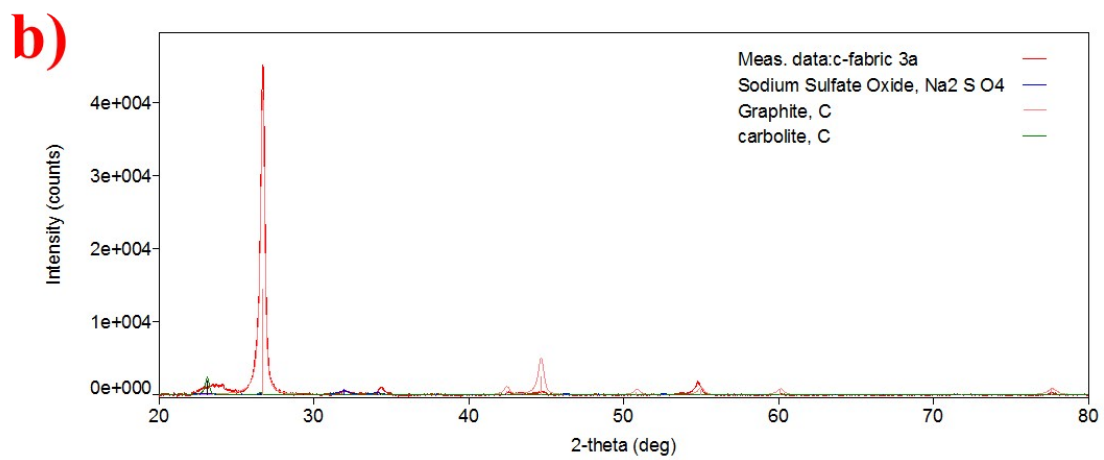
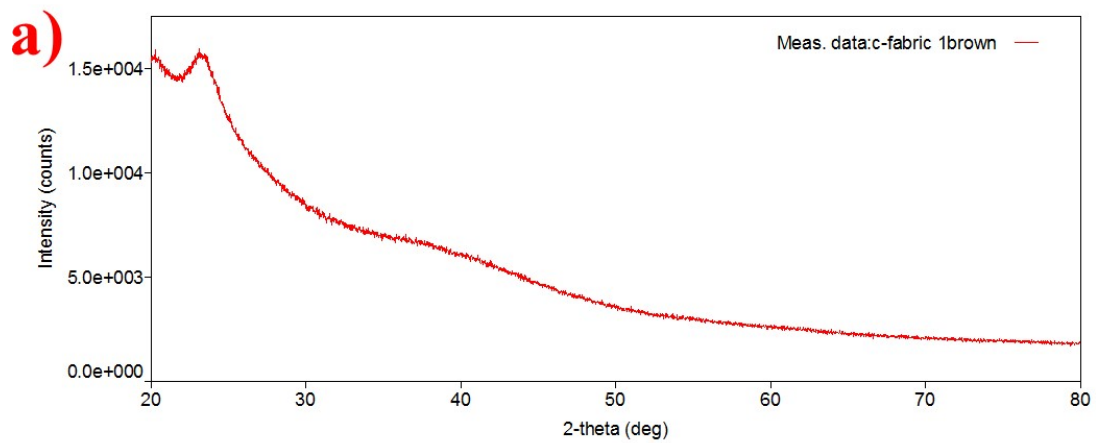
**Figure S2.** The experimental setup for electrothermal characterization of CWF heaters.



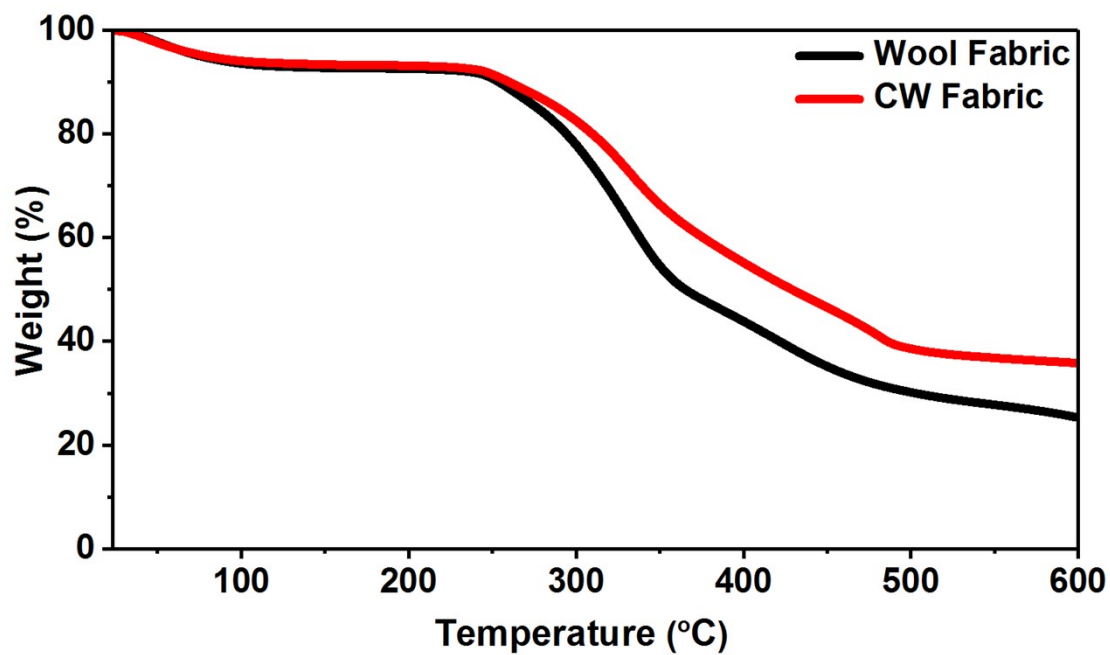
**Figure S3.** EDS analysis for the hybrid of GNPs/CB/SDBS powder; a) SEM image of the powder showing the focused area for EDS analysis, b-e) the EDS spectrum showing the intensity peaks related to the existing elements at areas 1, 2, 3, and 4 respectively. Tables showing the f) weight percentage and g) atomic percentage for each element at those specific areas.



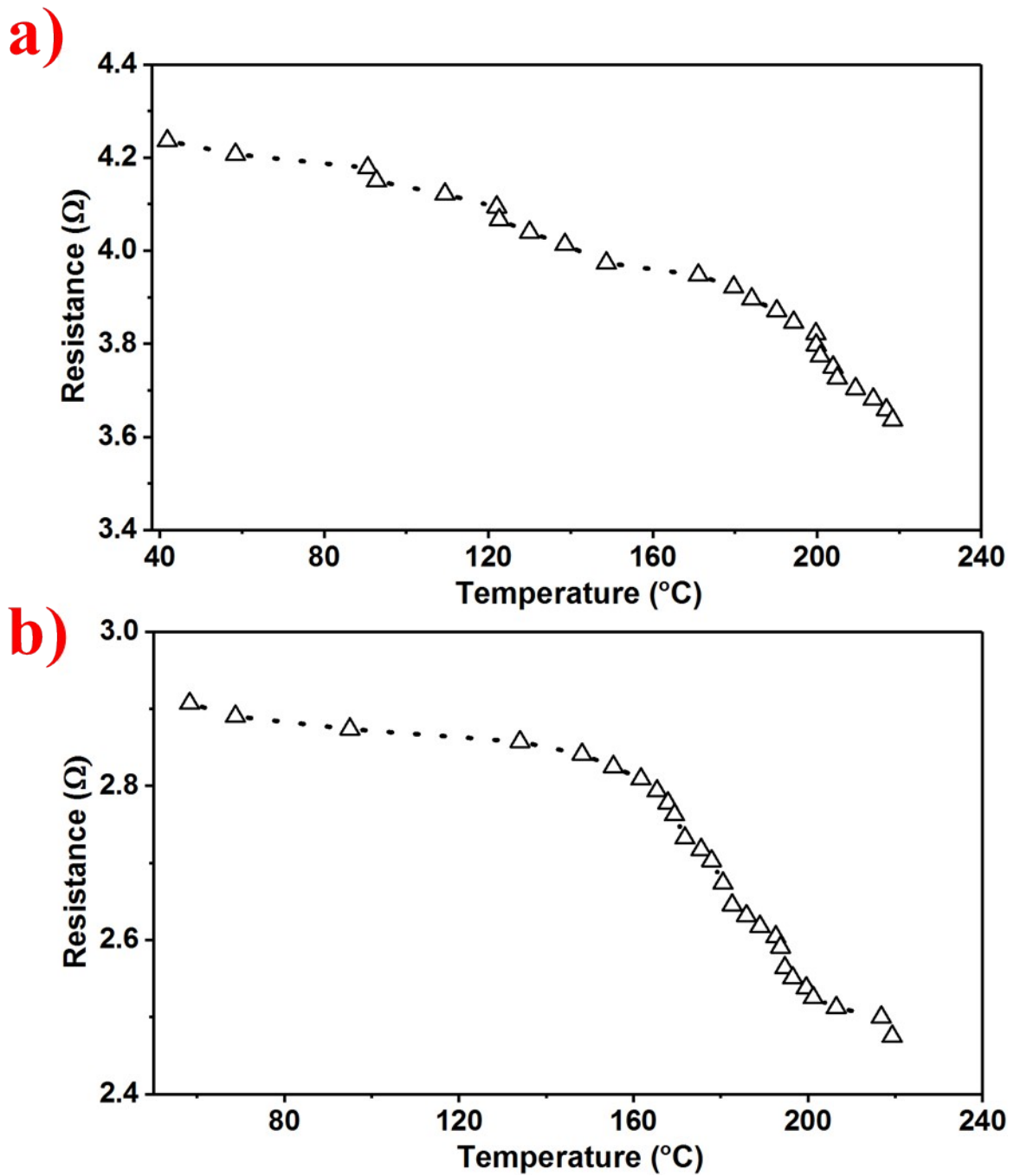
**Figure S4.** SEM images taken from the surface of the heaters after cold-pressing at high resolution indicating the homogenous distribution of GNP and CB particles in the conductive layer.



**Figure S5.** XRD spectra of a) neat wool fabric and b) CWF.

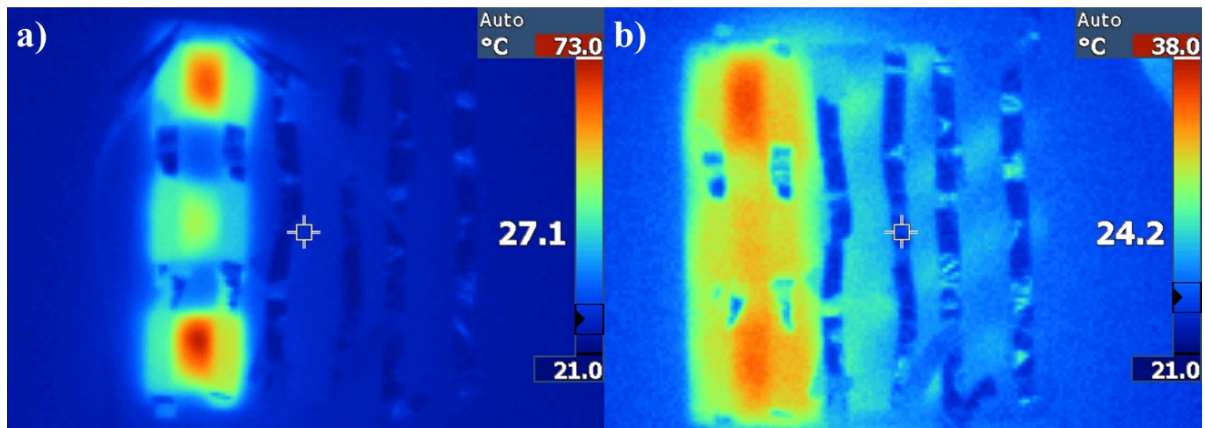


**Figure S6.** TGA thermograms of various fabrics, indicating their thermal behavior up to 600°C.



**Figure S7.** Resistance profile of a) a large CWF heater (45mm × 20mm) and b) a small CWF heater (25mm × 20mm-after second cold-pressing cycle) versus temperature.





**Figure S8.** Connection of CWF heaters in parallel: observation of temperature distribution on the surface of the demonstrator through IR images when three CWF heaters were linked.

**Table S1.** Comparison of the main performance of our CWF heaters and recently reported ones based on natural materials

<i>Heaters</i>	<i>Size</i>	<i>Maximum surface temperature (°C)</i>	<i>Applied voltage/ Input power</i>
	25mm × 20mm	After first cold-pressing: 238.2 ± 7.16	up to 4.5V (up to 7.2W)
<b><u>This work</u></b> (GNPs and CB coated wool fabric)	25mm × 20mm	After second cold-pressing cycle: 250.66 ± 2.46	up to 4V
	45mm × 20mm	After first cold-pressing: 238.26 ± 3.63	up to 6V (up to 8.5W)
Cotton fabric /PPy [1]	80mm × 80mm	40	3W
Cotton fabric /PPy [2]	70mm × 70mm	48	9V
Cotton fabric/ MnO <sub>2</sub> /rGO [3]	20mm × 20mm	36	15V
Cotton fabric/ f-MWCNTs [4]	50mm × 50 mm	84	60V
Cotton fabric/PEDOT:PSS [5]	10.8cm <sup>2</sup>	99.6	12V
Cotton fabric/ AgNWs [6]	Not reported	125	6V
Carbonized modal fabric [7]	1.2cm × 2.6cm	150	3.5V
Cotton fabric /SWCNTs [8]	10mm × 20mm 20mm × 40mm	96 45	40V 40V
Carbonized modal fabric [9]	1.2cm × 2.6cm	150	3.5V

## References:

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