Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Information

Synthesis of carbon nanofibers by thermal conversion of the molecular precursor 5,6;11,12-di-o-phenylenetetracene and its application in a chemiresistive gas sensor

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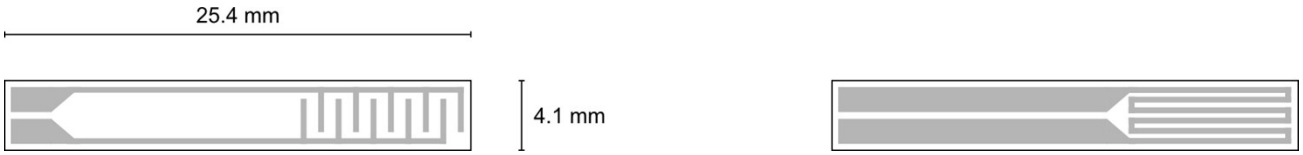

Fig. S1 Structure of the sensor substrate made of alumina with interdigitated Pt electrodes on the front side (left) and a Pt heater on the back side (right).

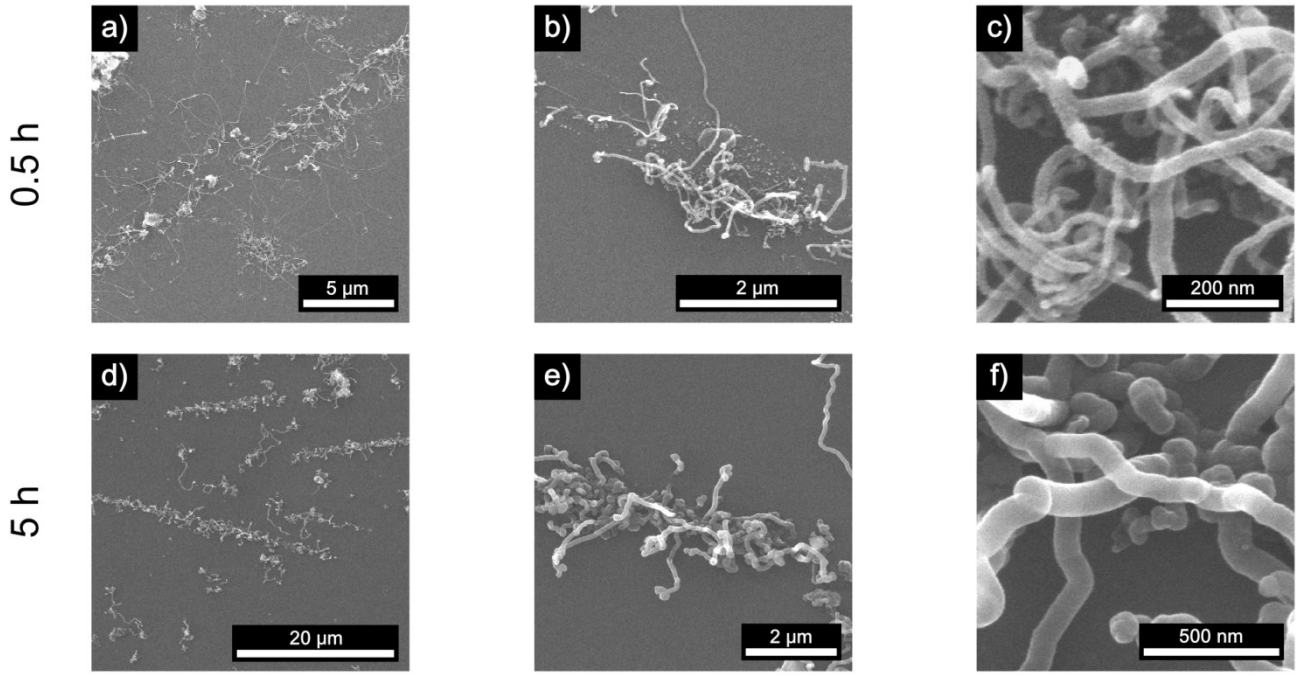

Fig. S2 Characterization of carbon nanofibers after thermal annealing of DOPT on SiO_2/Si at 1000 °C for different periods of time. SEM images of a-CNFs after thermal treatment for a) – c) 0.5 h and d) – f) 5 h.

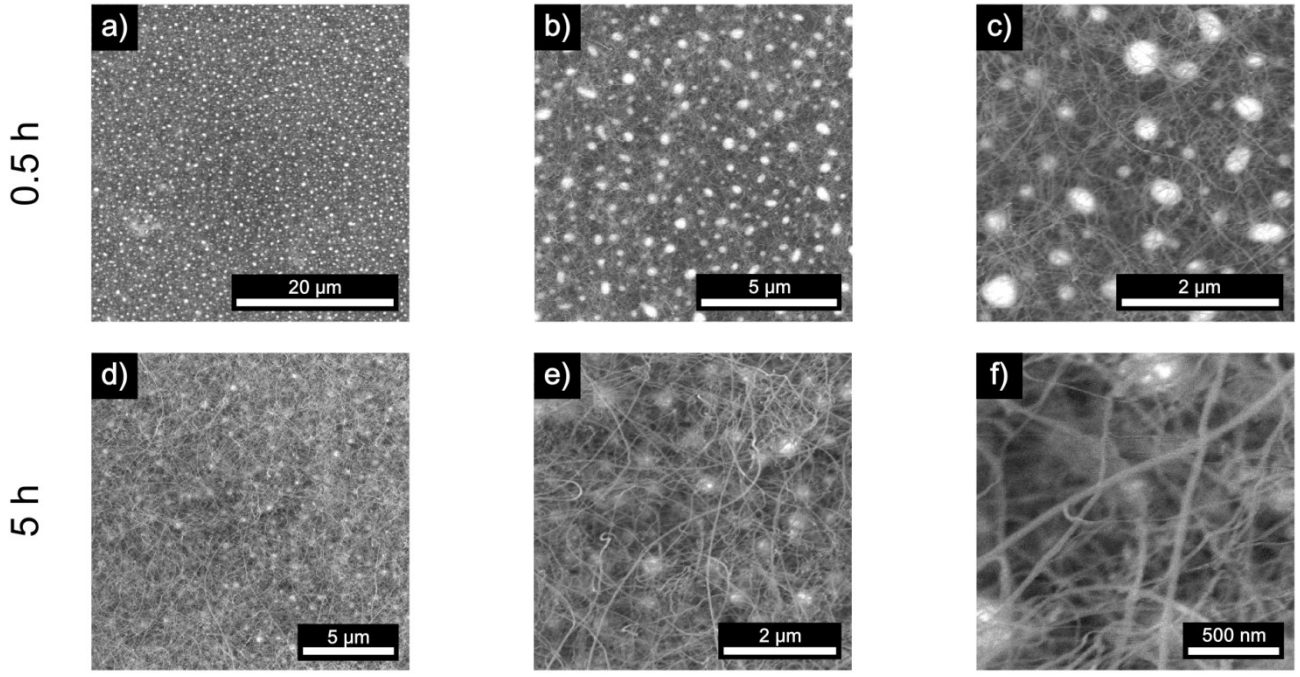

Fig. S3 Characterization of carbon nanofibers after thermal annealing of DOPT on Pt/Pd and SiO_2/Si at 1000 °C for different periods of time. SEM images of a-CNFs after thermal treatment for a) – c) 0.5 h and d) – f) 5 h.

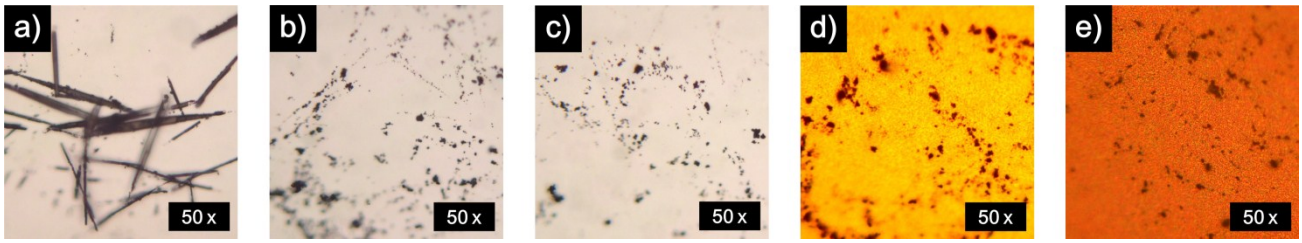

Fig. S4 Effect of increasing annealing temperature on the thermal decomposition of DOPT on Pt/Pd and SiO_2/Si. OM images at a magnification of 50x after annealing at a) 200 °C, b) 400 °C, c) 600 °C, d) 800 °C and e) 1000 °C for 5 h. Formation of nanoparticles can only be observed at 800 °C and higher.

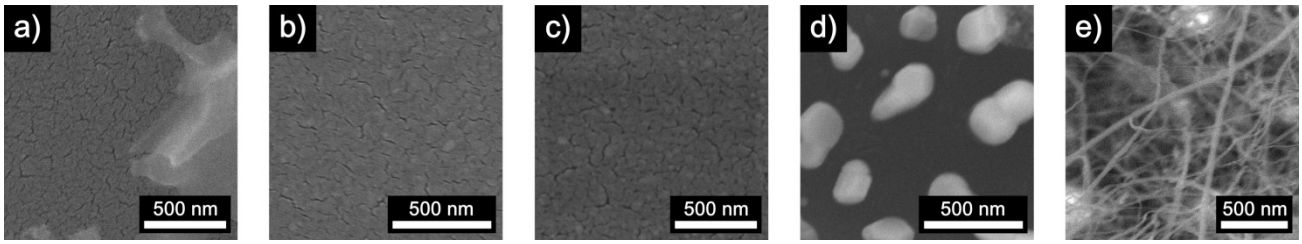

Fig. S5 Effect of increasing annealing temperatures on the thermal decomposition of DOPT on Pt/Pd and SiO_2/Si. SEM images after annealing at a) 200 °C, b) 400 °C, c) 600 °C, d) 800 °C and e) 1000 °C for 5 h.

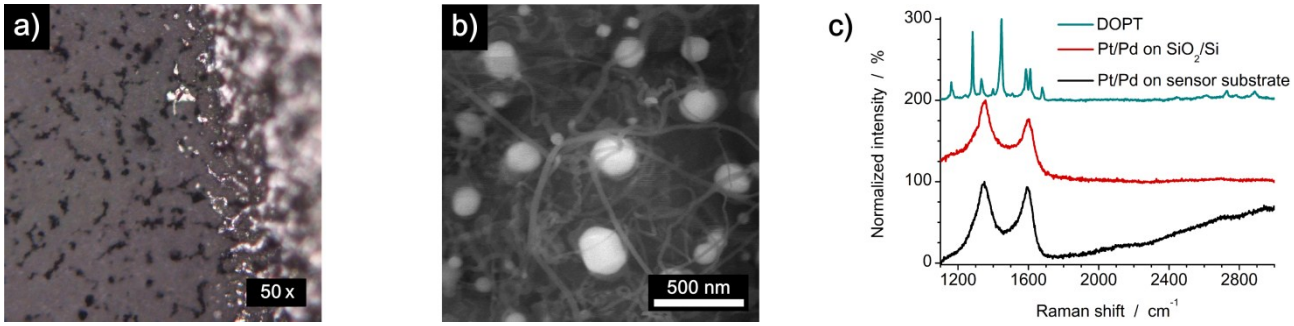

Fig. S6 SEM and Raman analysis of a-CNFs on a sensor substrate. a) OM image at a magnification of 50x. b) SEM image of as-prepared chemiresistors. c) Raman spectra of DOPT (cyan) and of a-CNFs synthesized on Pt/Pd and sensor substrate (black) and on Pt/Pd and SiO_2/Si wafer (red). Shift in baseline is due to the sensor substrate.

Table S1 Comparison of sensor data to the literature (RT = room temperature).

Sensing material	Structure of sensor	Time of exposure	Temperature	Target gas	LOD	Response time	Ref.
Amorphous CNFs	Chemiresistor	20 min	30 °C	NO_2 NH_3 SO_2	4 ppm 16 ppm 4 ppm	-	-
Mesoporous CNFs	FET	-	RT	NO_2	< 5 ppm	< 10 s	[1]
WO_3 nanonodule + CNFs	Chemiresistor	-	RT	NO_2	1 ppm	-	[2]
Helicoldal CNFs (+ Au or Pd)	Chemiresistor	30 min	120 °C	NH_3	-	5 min	[3]
CNFs + Polypyrrole	Chemiresistor	1 min	RT	NH_3	10 ppm	-	[4]
CNTs	Chemiresistor	1 min	RT	NO_2	125 ppt	-	[5]
CNTs	Chemiresistor	-	RT	NH_3	3 ppb	-	[6]

1 L. Liao, M. Zheng, Z. Zhang, B. Yan, X. Chang, G. Ji, Z. Shen, T. Wu, J. Cao, J. Zhang, H. Gong, J. Cao and T. Yu, *Carbon N. Y.*, 2009, **47**, 1841–1845.

2 J. S. Lee, O. S. Kwon, D. H. Shin and J. Jang, *J. Mater. Chem. A*, 2013, **1**, 9099–9106.

3 S. Claramunt, O. Monereo, M. Boix, R. Leghrib, J. D. Prades, A. Cornet, P. Merino, C. Merino and A. Cirera, *Sensors Actuators B Chem.*, 2013, **187**, 401–406.

4 J. Jang and J. Bae, *Sensors Actuators B Chem.*, 2007, **122**, 7–13.

5 D. Kumar, P. Chaturvedi, P. Saho, P. Jha, A. Chouksey, M. Lal, J. S. B. S. Rawat, R. P. Tandon and P. K. Chaudhury, *Sensors Actuators B Chem.*, 2017, **240**, 1134–1140.

6 F. Rigoni, S. Tognolini, P. Borghetti, G. Drera, S. Pagliara, A. Goldoni and L. Sangaletti, *Analyst*, 2013, **138**, 7392–7399.