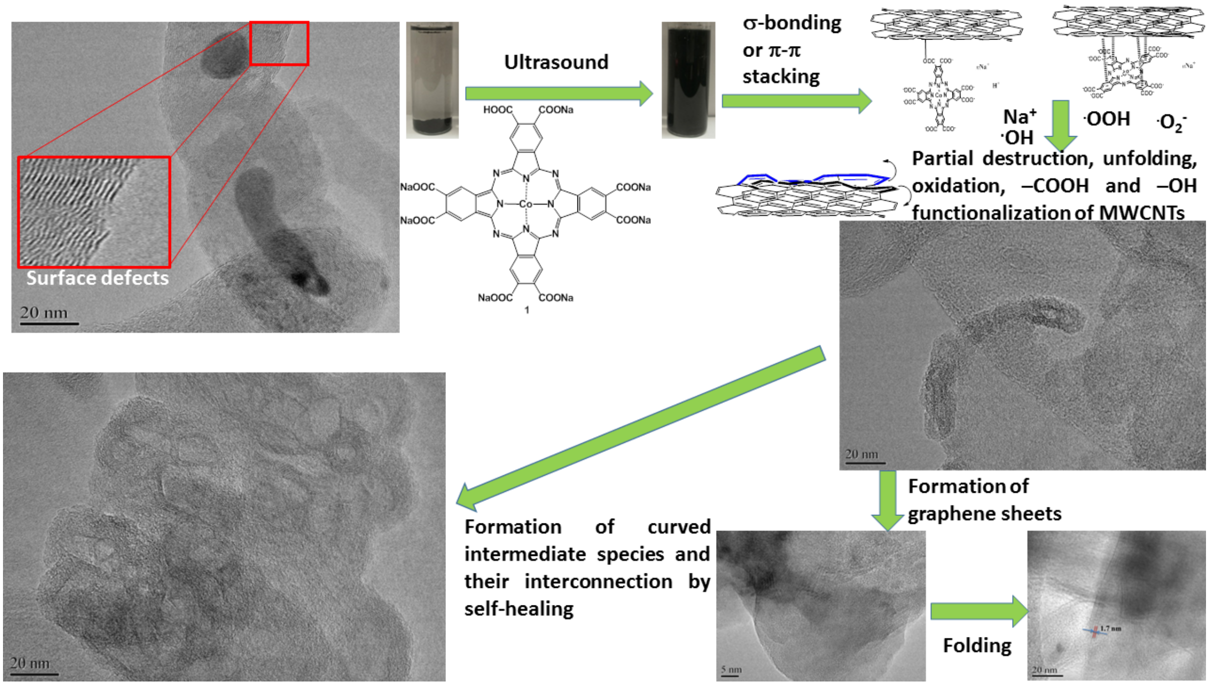
Electronic Supplementary Material (ESI) for RSC Advances.

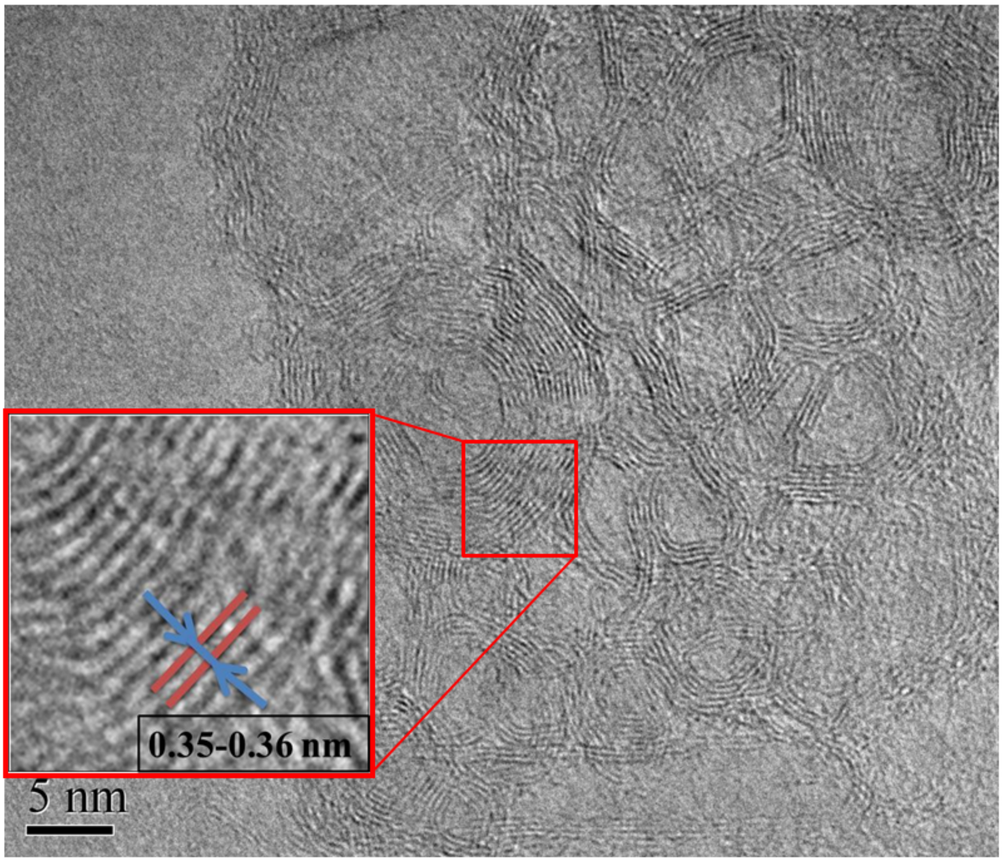

## Supplementary material captions

**S1.** Possible formation mechanism for carbon nano-onions and other products in TP-MWCNTs dispersions.

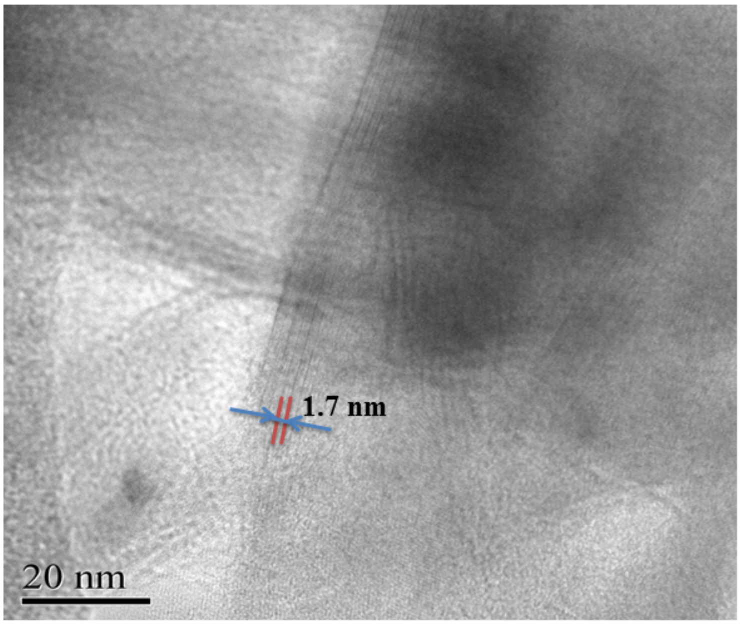
**S2.** (Supplementary Table 1). Raman spectra data of MWCNTs-TP interaction products and their comparison with those reported earlier.
**S3.** High resolution image of nano-onion structures.
**S4.** High-resolution image of products in concentrated dispersions TP-MWCNTs.
**S5**. XPS characterization results.




**S1.** Possible formation mechanism for carbon nano-onions and other products in TP-MWCNTs dispersions.




**S3.** High resolution image of nano-onion structures.



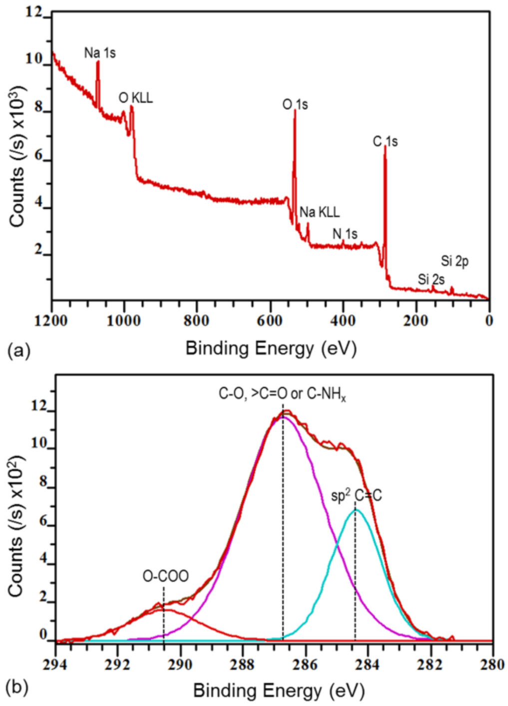

**S4.** High-resolution image of products in concentrated dispersions TP-MWCNTs.

**S5**. XPS characterization results.

**Experimental Details**

XPS characterization:

The chemical composition of one selected carbon nanotube sample was investigated by X-ray photoelectron spectroscopy (XPS) on a Perkin-Elmer Phi 560 ESCA/SAM system and the spectra were acquired using a non-monochromated Al Kα excitation source. The Al Kα excitation is characteristic unresolved $K\ \alpha_{1,2}$ and has a characteristic energy of 1253.6 eV. Survey scans were conducted in the 0 to 1200-eV range at 0.5-eV steps. High-resolution scans were conducted for C 1s peak in the 280 to 294-eV range at 0.1-eV steps.




**Results and Discussion**

Fig. (a) presents general XPS survey spectrum of TF-CNT sample exhibiting mainly the presence of C, O, N, Na and Si. This presence of the Si was from the contamination of glass (the samples were synthesized in a glass vial under ultrasonic treatment and dried on glass surface). Fig. (b) shows the high-resolution XPS spectra of the C 1s peak which can be decomposed into the three components at binding energy of 284.4 eV, 286.7 eV and 290.5 eV that can be assigned to $sp^2$ C=C, C-O (>C=O or C-$NH_x$) and O-COO, respectively.[1]


T.I.T. Okpalugo, P. Papakonstantinou, H. Murphy, J. McLaughlin, N.M.D. Brown, High resolution XPS characterization of chemical functionalized MWCNTs and SWCNTs, Carbon 43 (2005) 153–161

**S2. Supplemental Table 1**. Raman spectra data of MWCNTs-TP interaction products and their comparison with those reported earlier.

| Monomeric TP[i] | | MWCNTs;[ii] frequency, $cm^{-1}$ | Nano-onions;[iii] frequency, $cm^{-1}$ | MWCNTs-TP interaction product containing nano-onions; frequency, $cm^{-1}$ |
|---|---|---|---|---|
| Frequency, $cm^{-1}$ | $I_{rel.}$, % | | | |
| 1117 | 40 | | | 1040-1070, 1150 |
| 1210 | 90 | | | |
| 1320 | 90 | 1300-1320 | 1310-1350 | 1300-1320 |
| 1396 | 40 | | | 1390, 1440 |
| 1536 | 100 | 1590-1600 | 1600-1630 | 1580-1610<br>1530-1540,<br>1460-1470 |
| | | ~2700 | ~2700, ~2800 | ~2650-2750 |

[i] A.V. Feofanov, A.I. Grichine, L.A. Shitova, T.A. Karmakova, R.I. Yakubovskaya, M. Egret-Charlier, P. Vigny. Confocal Raman Microspectroscopy and Imaging Study of Theraphthal in Living Cancer Cells. *Biophys. J.*, 2000, **78**(1), 499–512.

[ii] C. Portet, G. Yushin, Y. Gogotsi. Electrochemical performance of carbon onions, nanodiamonds, carbon black and multiwalled nanotubes in electrical double layer capacitors. *Carbon*, 2007, **45**, 2511–2518.

[iii] J.K. McDonough, A.I. Frolov, V. Presser, J. Niu, C.H. Miller, T. Ubieto, M.V. Fedorov, Y. Gogotsi. Influence of the structure of carbon onions on their electrochemical performance in supercapacitor electrodes. *Carbon*, 2012, **50**, 3298–3309.