Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

Supplementary information.

Elicarb MW high purity MWCNT powder and Elicarb SW high purity SWCNT were purchased from Thomas Swan &Co Ltd and were used in this study without further purification.

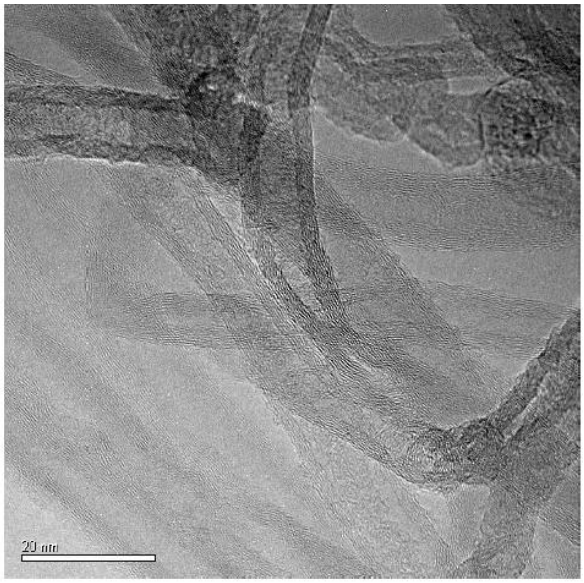


Fig. S1. TEM image of Elicarb MW carbon nanotubes, used in this study (provided by manufacturer). MWCNT have mean diameter ca. 10 nm and consist of 5-8 walls. From these values we estimated that ca. 20% of carbon belongs to the outer wall.

Table S1. Estimation of carbon content in the shells of a model carbon nanotube (6 walls, with outer diameter of 10 nm)

# of the shell	shell diameter (nm)	calculated number of carbon atoms per 100nm of tube length (for *zig-zag* & *arm-chair* nanotube geometries with C-C bond length of 1.42 Å)	C fraction per shell
1	10	119931	20.1%
2	9.32	111776	18.7%
3	8.64	103620	17.3%
4	7.96	95465	16.0%
5	7.28	87310	14.6%
6	6.6	79154	13.3%

EDA functionalised MWCNT form dense agglomerates under drying; no degradation of tubes was observed in SEM images.

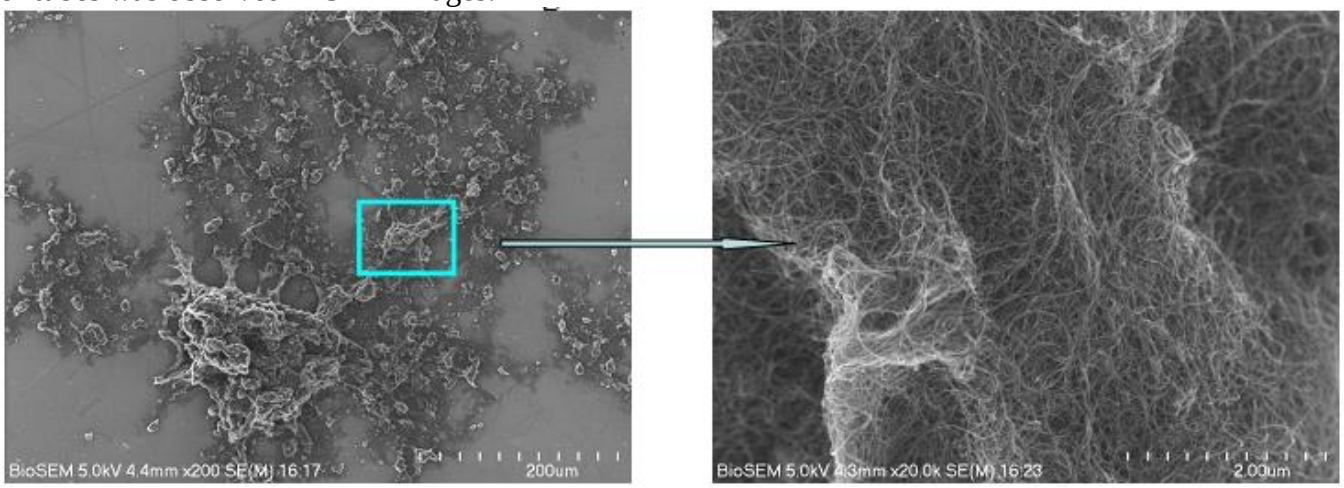


Fig. S2. SEM images of EDA functionalised MWCNT (reaction performed at 70 ^{o}C, drop casting on Si from methylene chloride dispersion), taken on cold field emission Scanning Electron microscope Hitachi 4700.

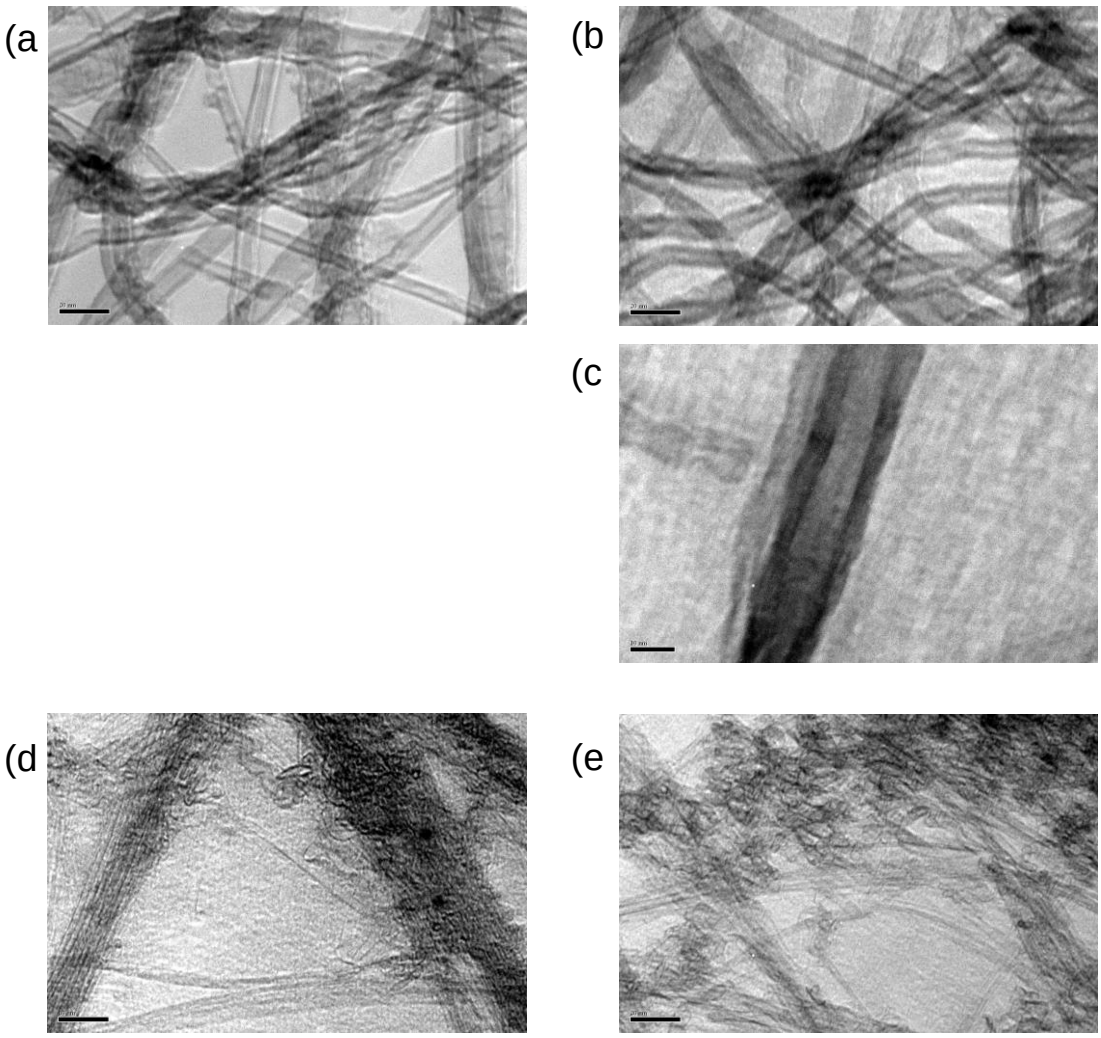
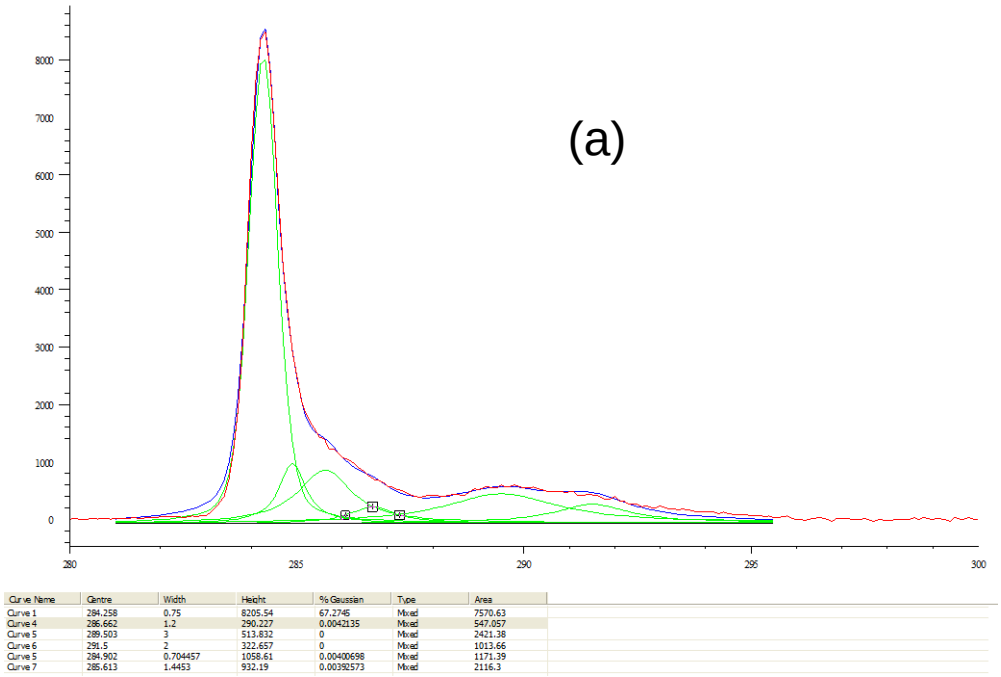


Fig. S3. TEM images of (a) pristine MWCNT, scale bar 20nm; (b) MWCNT-EDA (material treated with Li-EDA at 55^{o}C), scale bar 20nm; (c) MWCNT-EDA, scale bar 10 nm; (d) pristine SWCNT, scale bar 20nm; (e) SWCNT-EDA, scale bar 20nm. Images were taken on Philips CM 120 Biotwin instrument. Carbon nanotube samples were dispersed in water (functionalised species formed more stable dispersions) and transferred on Cu grids.



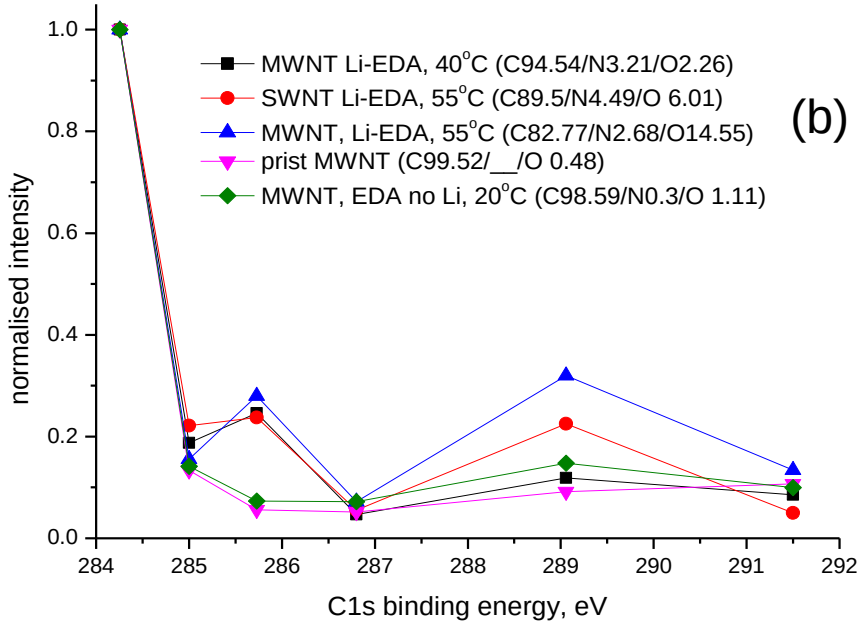


Fig. S4. Peak fit analysis of C1s area of XPS spectra (a) typical peak fitting graph (shown for MWCNT treated with Li-EDA at 55°C sample) with the peaks set around 284.4 eV (graphite), 284,9 eV (amorphous carbon, intercalated graphite - carbon from defect sites of CNT), 285.7 eV (typical for C-N), 286.8 eV (typical for C-O), 289.2

eV (C=O derivatives, carbonates) and 291.5 eV (π -π* transition in carbonaceous materials); (b) the plot of normalised peak intensities in pristine and functionalised CNT species: an increase of the fraction of peak around 285.7 eV (C-N) in EDA grafted CNTs is clearly seen, relative to pristine and non-reacted materials. The assignment of C1s XPS shifts was performed using the La Surface database (http://www.lasurface.com/database/elementxps.php)

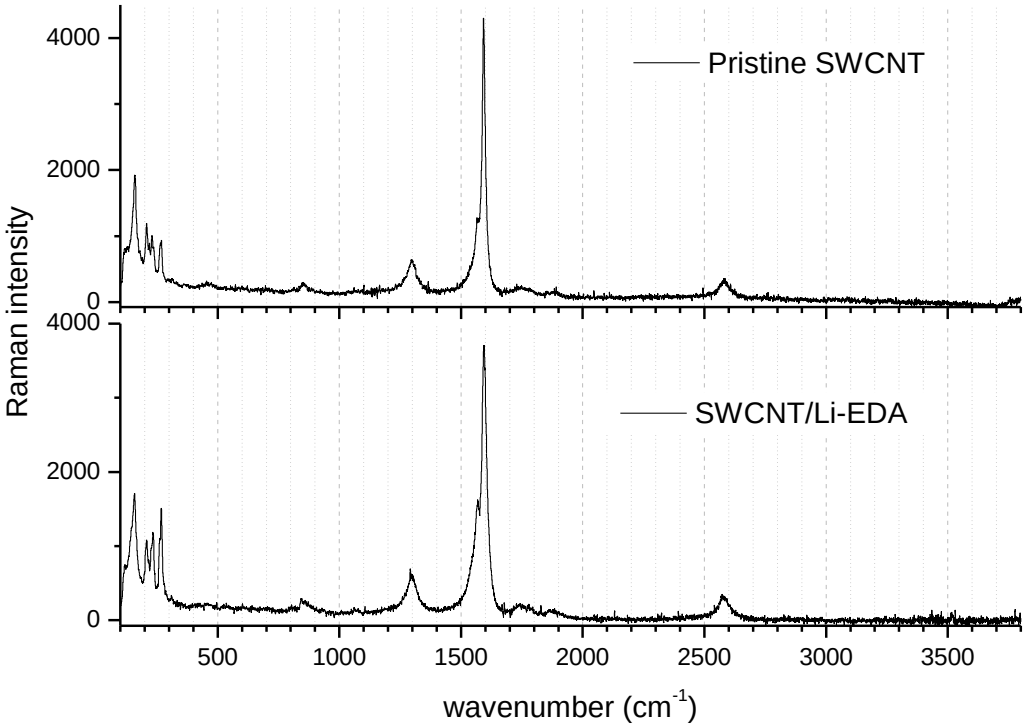


Fig. 5S. Raman spectra ($\lambda_{ex.}$ 785 nm) of pristine SWCNT (top) and functionalised SWCNT/Li-EDA (bottom).

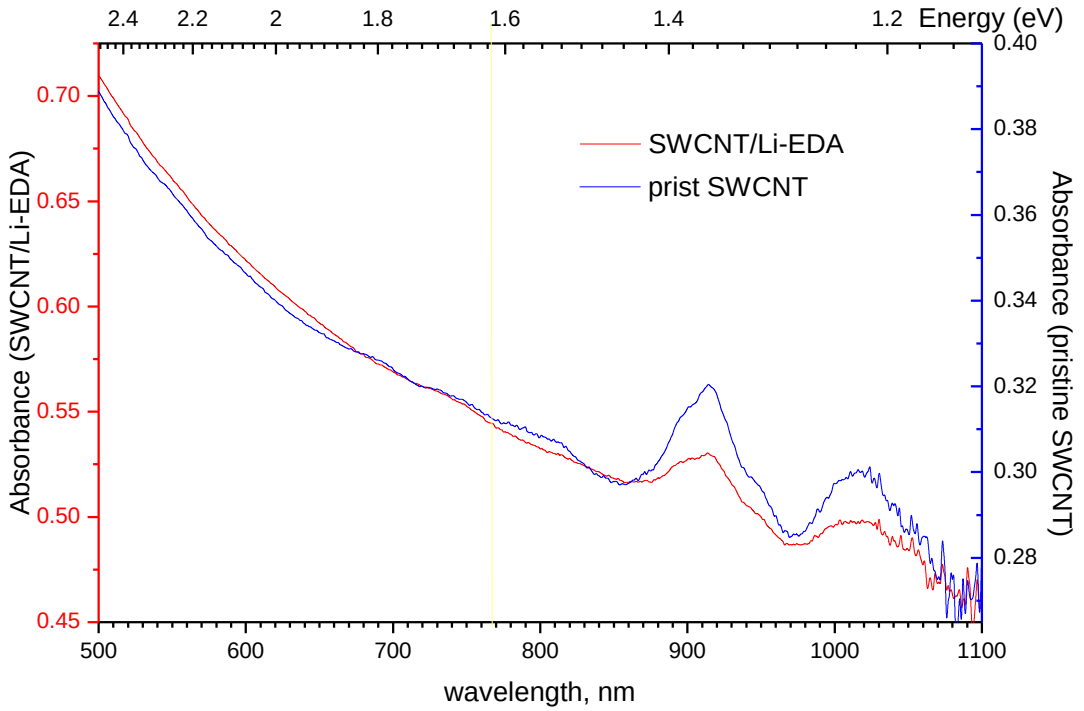


Fig. 6S. UV-Vis-NIR spectra of pristine SWCNT (blue trace) and EDA functionalised SWCNT (red trace). The spectra were measured for solutions of materials in DMF (10 min. bath sonication in ice, then centrifugation 5000 x g/15 min). The optical density of solution of EDA functionalised SWCNT is ~1.7 times bigger than for pristine material, indicating its higher solubility. Note, that absorbance axis scales for materials are different.