



Supplementary material to

The performance of heteroatom-doped carbon nanotubes synthesized *via* a hydrothermal method on the oxygen reduction reaction and specific capacitance

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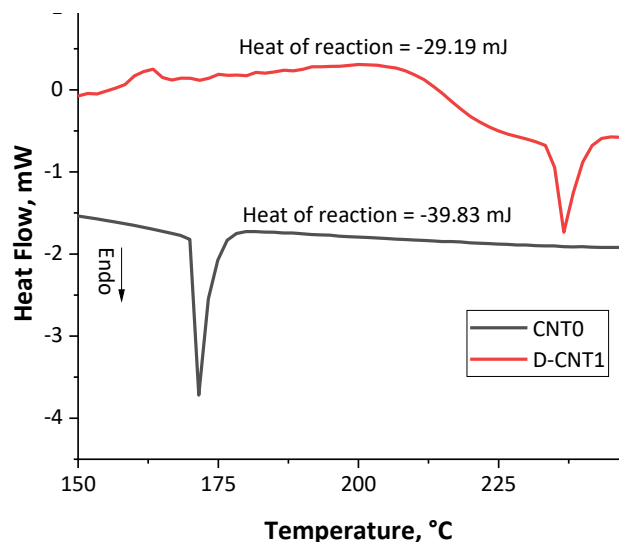


Figure S-1. DSC thermograms for the sample of neat CNTs (CNT0) and D-CNT1

In Figure S-2, both D-CNT1 and D-CNT2 samples show major peaks at around 724, 965, 1023, 1198, 1381, 1464 and 1581 cm^{-1} . The sample D-CNT1 show absorption peaks at 1023 and 1198 cm^{-1} which were shifted to a higher wavenumber side (1063 cm^{-1}) and 1223 cm^{-1} in D-CNT2, respectively. The peak at 1381 cm^{-1} corresponds to the characteristic absorbance of single C–N bonds [1]. The peaks at 1464 and 1581 cm^{-1} are attributed to C N stretching modes. The peak in the 1464 cm^{-1} region appears strong in D-CNT2. Besides, pronounced bands at 1747, 1980, 2029, 2136, 2854, and 2928 cm^{-1} were assigned to C–H bonding and appear strong in D-CNT2. A small peak at 1508 cm^{-1} was observed in D-CNT2. The absorption in the 1200 to 1600 cm^{-1} region could be assigned to the imine bond (C=N)

and C-N/N-H stretching. In addition, the features at 3245 and 3486 cm^{-1} that could be assigned to the stretching and deformation mode of the NH_2 group appear only in D-CNT2. The FTIR spectra revealed that the N atoms are bonded into the carbon network. We therefore strongly believe that N doping of graphene sheets may be taking place and a C-N bond identical to the sp^3 bonded carbon nitride sample may be forming. The features between 2851 and 2925 cm^{-1} are consistent with C-Hx stretching vibrations of chemisorbed hydrogen of various types presents in all carbon films [2,3]. Furthermore, a peak at 1063 cm^{-1} appears in D-CNT2 coming from the S=O stretching [4].

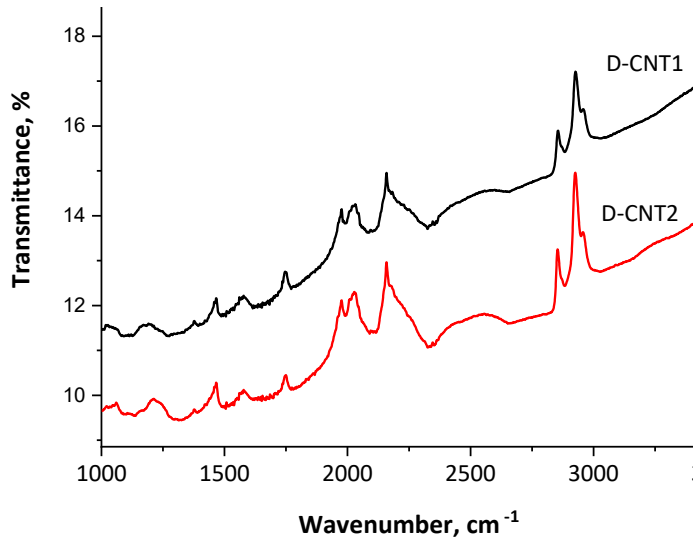


Figure S-2. FT-IR spectra for the sample of D-CNT1 and D-CNT2

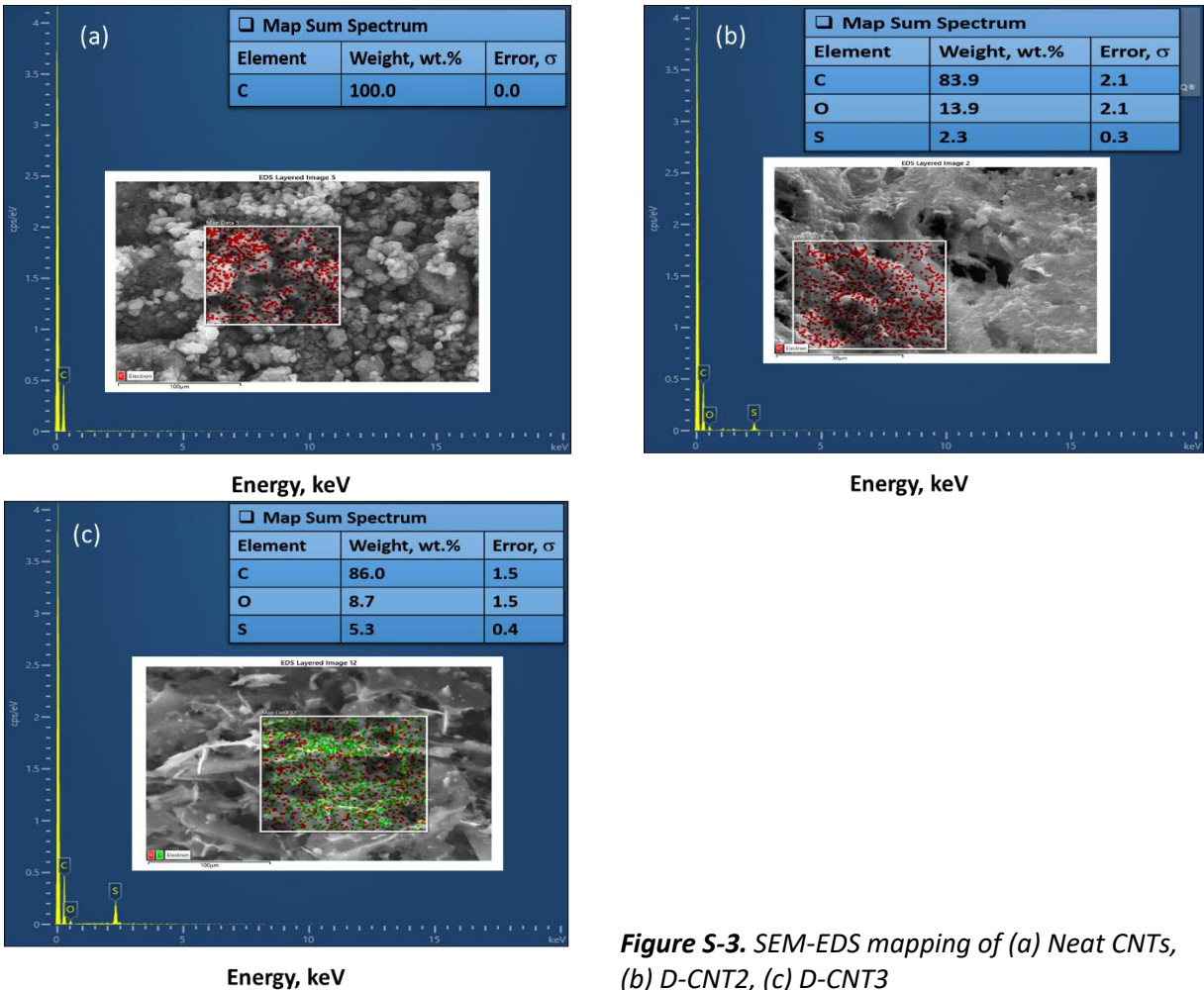


Figure S-3. SEM-EDS mapping of (a) Neat CNTs, (b) D-CNT2, (c) D-CNT3

References

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