Supplementary Information

Si-mediated fabrication of reduced graphene oxide and its hybrids for electrode materials

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Experiemtal condition for hybrids:

Graphene oxide (GO) was synthesized according to the modified Hummers' method. Then 5 mg of GO and 20 mg of multiwall carbon nanotubes (MWCNT) / carbon nanofibers (CNF) were taken in 10 ml of dimethylformamide (DMF) solution in 20 ml glass cointainer and sonicated for 30 minutes in ultrasonic bath. After that, 200 µl of this mixture solution (GO-MWCNT/CNF) was allowed to dry on Si substrate (~ 1 cm^2). After that, 1M KOH (50 µl) solution was added slowly to the dried mixture up to 5 minutes. This KOH solution reacts with the Si substrate and liberates hydrogen gas which reduces the GO and formed the hybrids with MWCNT/CNF. The hybrids were collected and washed several times with KOH solution as well as water and ethanol solution before characterization and electrochemcial measurments. This MWCNTs was synthesized via pyrolysis of benzene in presence of ferrocene followed by ref. 1 and the CNF was purchased commercially from the Sigma Aldrich.

ESI-1

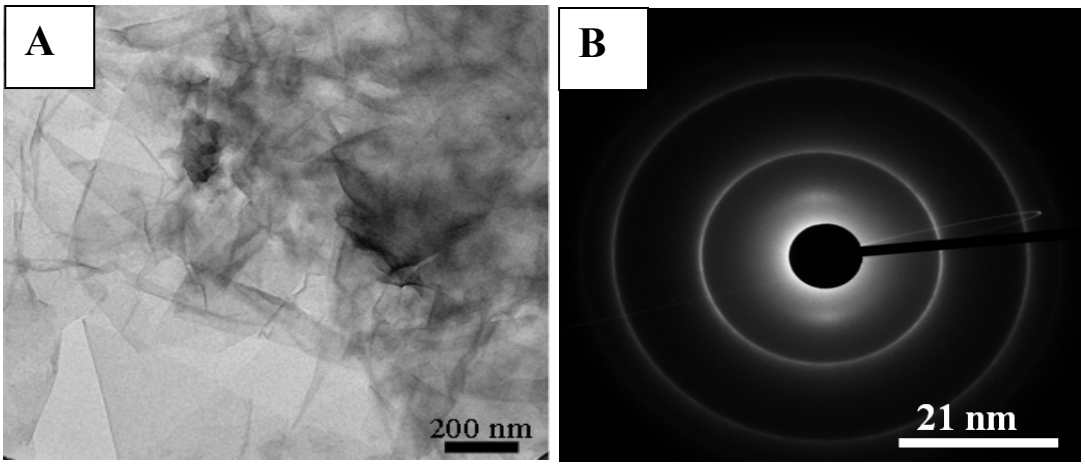

Fig.1 (A)TEM image of graphene oxide (GO) and (B) the ring like SAED pattern.

ESI-2

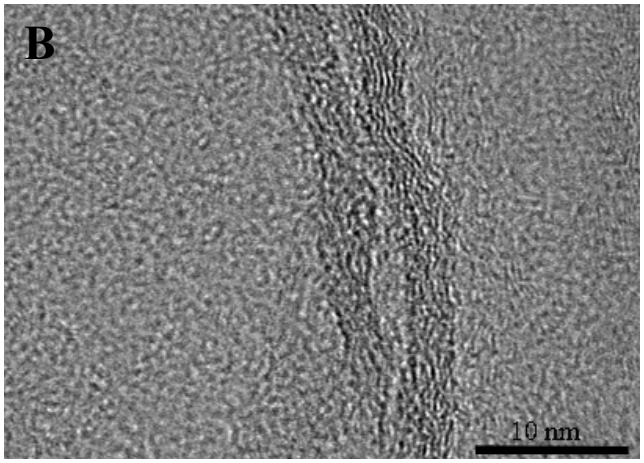

Fig. 2 HTERM image of edge portion of rGO.

ESI-3

XPS analysis of GO

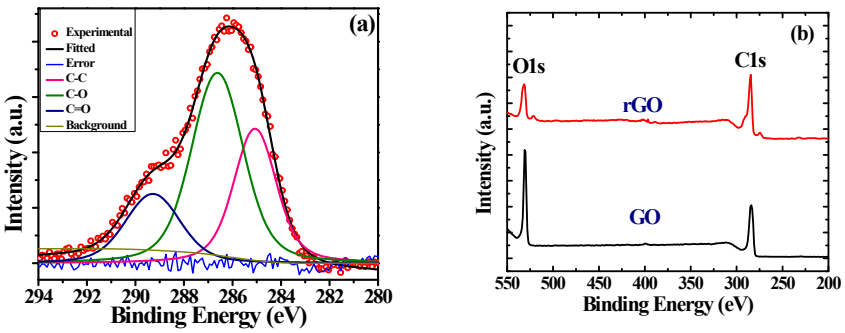

Fig.3 (a) C1s spectra of GO and (b) survey XPS spectra of GO and rGO.

ESI-4

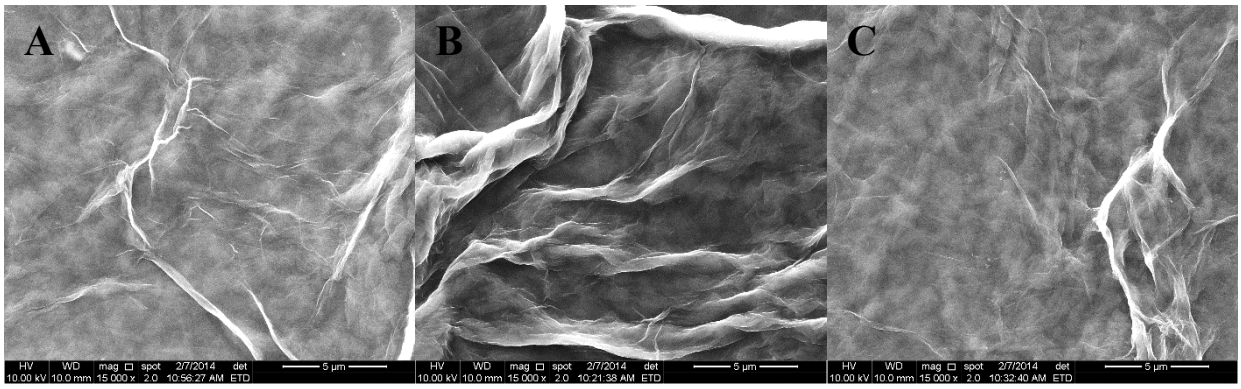

Fig.4 (A-C) FESEM images of crumpled morphology of 1st, 3rd and 5th rGO reduced by the same Si substrate.

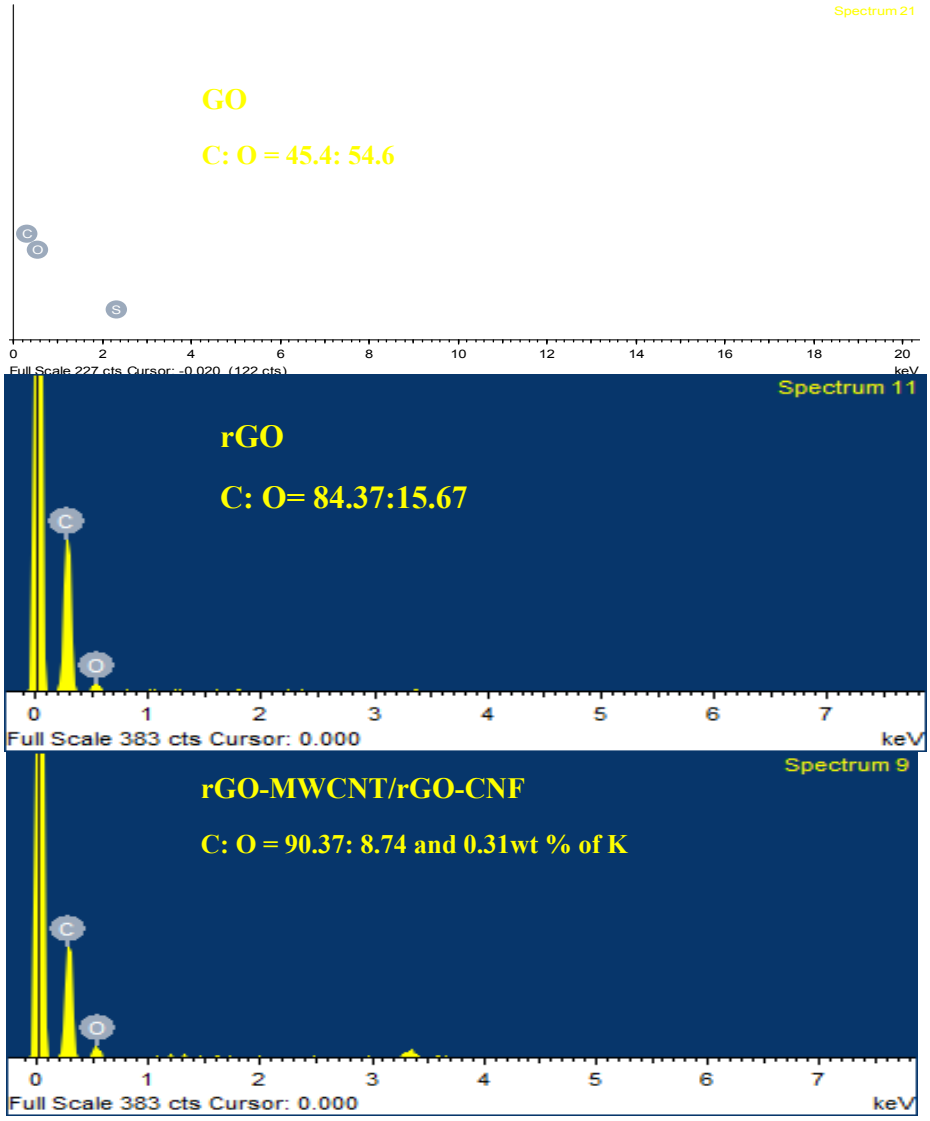

Fig. 5. EDS spectra of GO, rGO and the hybrids.

ESI-5:

XRD of rGO/CNT hybrids:

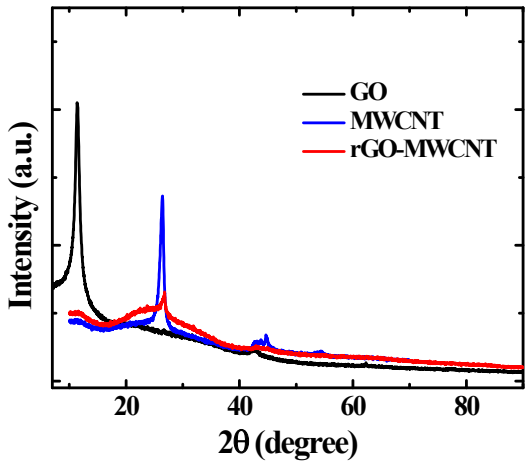

Fig. 6 XRD patterns of the GO (black line), rGO-MWCNT hybrids (red line) and MWCNT only (blue line).

ESI-6:

EDS spectra of the top portion of the rGO film after the reduction by Si/KOH.

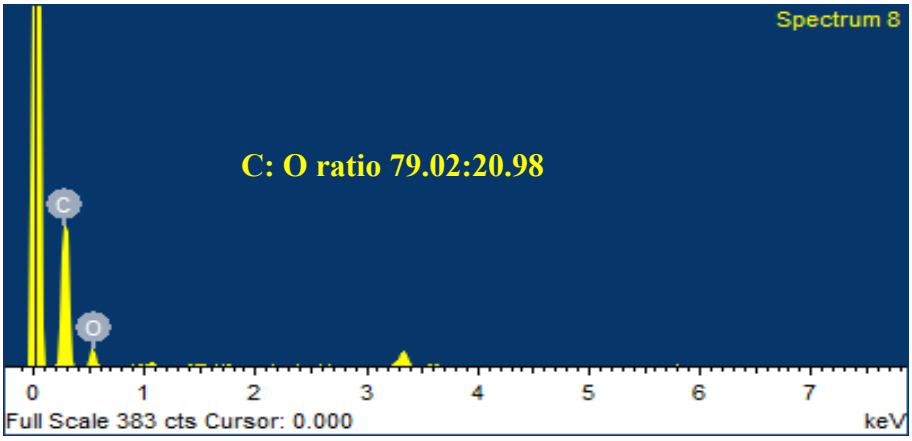

Fig. 7 The EDS spectra of the top of the rGO film after the reduction via Si surface by KOH solution. (The percentage of oxygen containing functional group is higher compared to bottom of the film. This is probably due to the release of hydrogen from the bottom of the film).

ESI-7:

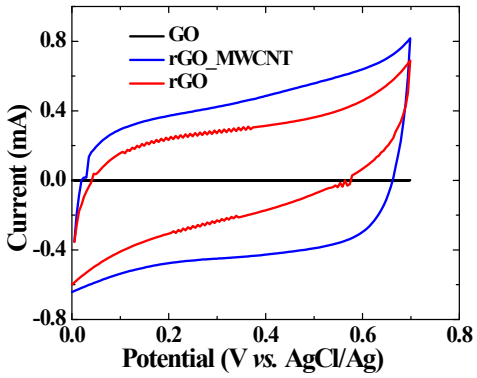

Fig. 7 The cyclic voltammetry was performed in 0.1 M Na_2SO_4 solution as electrolyte with the scan rate 10 mV/S.

Reference

1. G. K Goswami, R. Nandan, B. K. Barman, K. K. Nanda, *J. Mater. Chem. A*, 2013, **1**, 3133-3139.