Supplementary Information

Facile Synthesis and Characterization of Reduced Graphene Oxide / Halloysite Nanotubes / Hexagonal Boron Nitride (RGO/HNT/h-BN) Hybrid Nanocomposite and its Potential Application as Hydrogen Storage

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XRD Analysis

Fig. S1 shows the XRD pattern of graphene oxide (GO) where a strong and sharp diffraction peak is observed at 2θ =12.02° with an interlayer spacing of 0.77 nm along the (002) orientation [1,2].

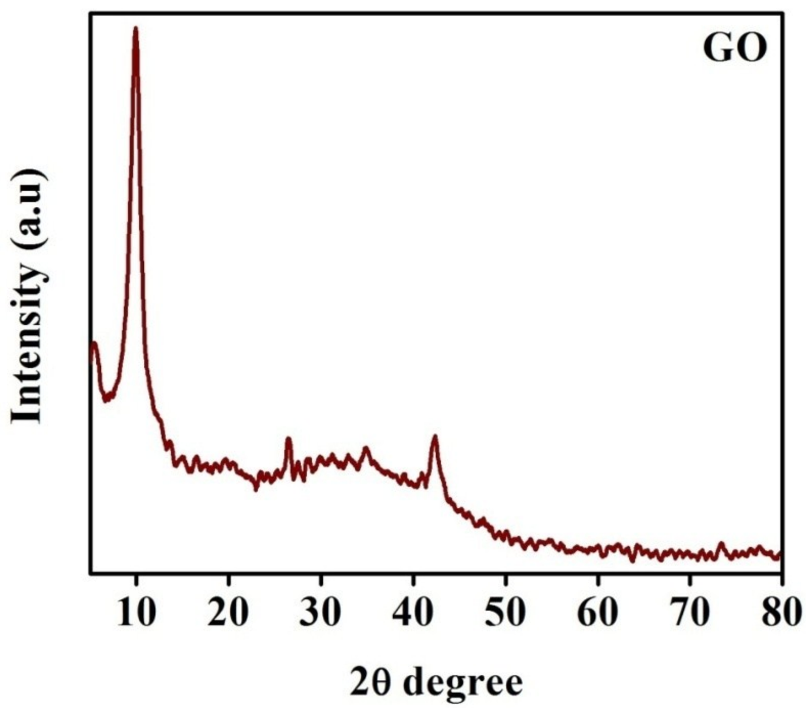

Fig. S1 - XRD pattern of GO

FTIR Analysis

Fig. S2 shows the FTIR spectrum of GO and the characteistic peaks of GO appear at 3423, 2037, 1750, 1627, 1222 and 1051 cm^{-1} are assigned to the O-H stretching of absorbed H_2O molecules, C-H strectching, C=O strectching vibrations of carbonyl and carboxylic groups, sp^2 unoxidized C=C strectching, epoxy C-O stretching vibrations and alkoxy C-O stretching vibrations, respectively [3,4]. These modes of vibrations confirm the presence of various oxygen functionalities in the prepared GO.

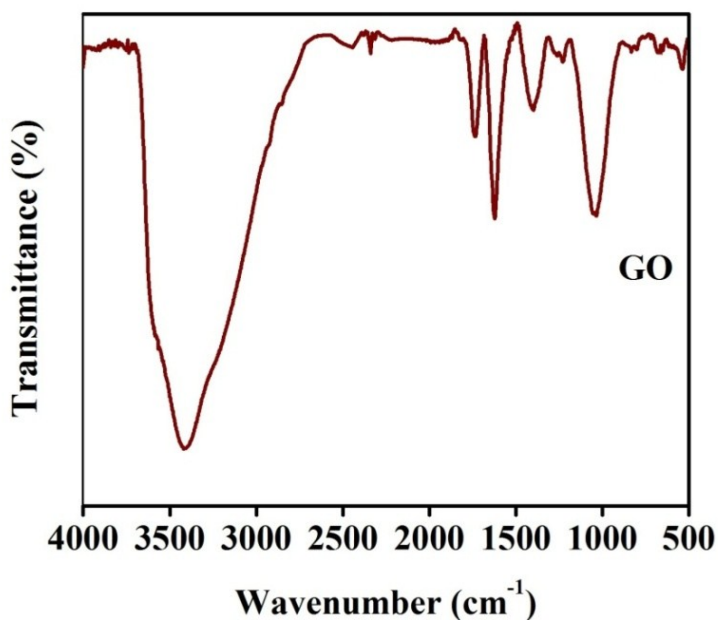

Fig. S2 - FTIR spectrum of GO

UV/Vis Analysis

The UV-Vis spectrum of GO has a sharp peak at 233 nm with a shoulder peak at 290 nm. The peak at 233 nm is attributed to the π - π* transition of C=C bonds while the band at 290 nm corresponds to the n - π* transition of C=O bonds which further confirms the presence of carbonyl groups in GO. The absorption peak at 233 nm is red-shifted during the reduction of GO into reduced graphene oxide (RGO) [5].

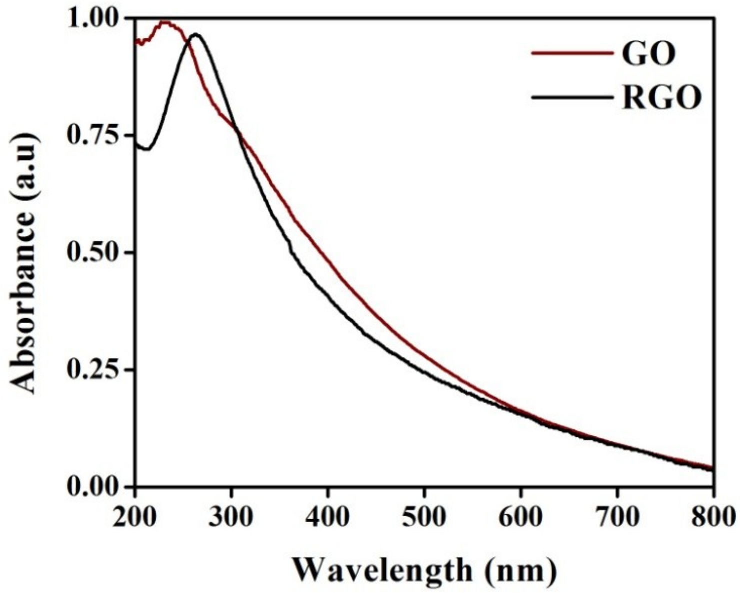

Fig. S3 - UV/Vis spectra of GO and RGO

Elemental Mapping Analysis

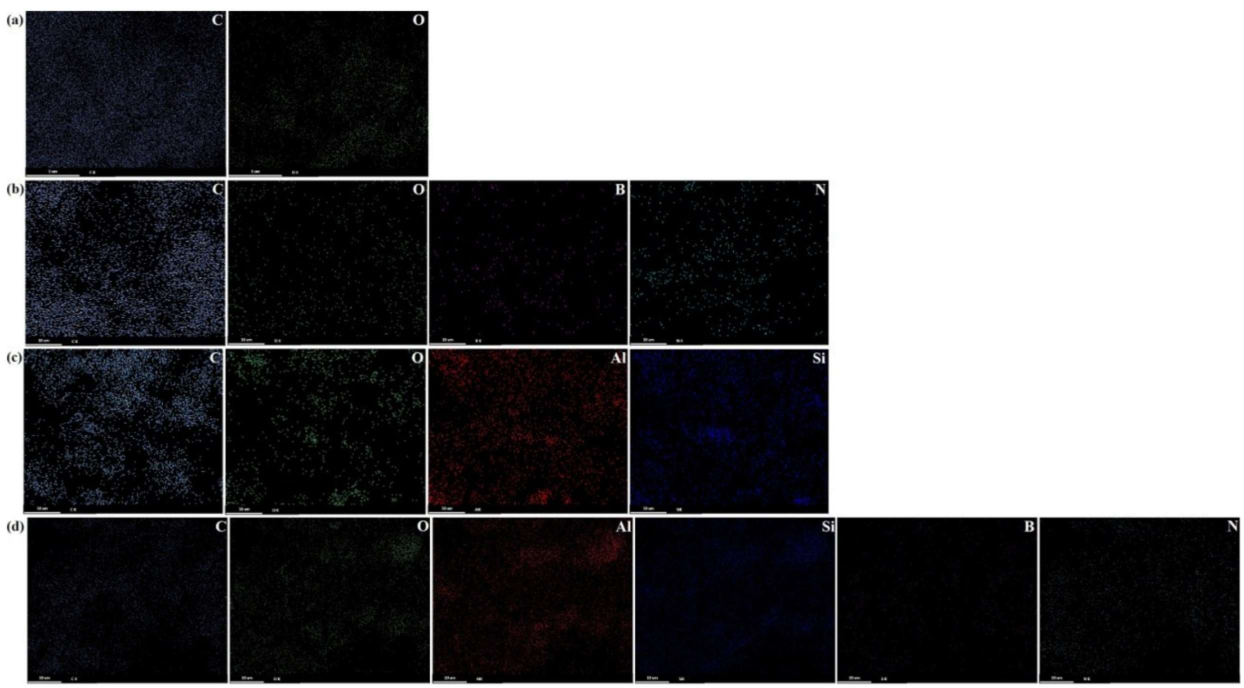

Fig. S4 - Elemental mapping images of (a) RGO (b) RGO/h-BN (c) RGO/A-HNT and (d) RGO/A-HNT/h-BN hybrid nanocomposites

TG Analysis

The TGA curve of GO is depicted in Fig. S5. It is observed that the prepared GO has the initial weight loss at below 100 °C which is attributed to the evaporation of adsorbed water and the second weight loss at 150 °C is due to the rapid decomposition of oxygen containing functional groups. These oxygen containing groups may arise due to the trapping of more water molecules between the GO layers [6]. These findings are well supported by XRD, FTIR and UV-Vis studies.

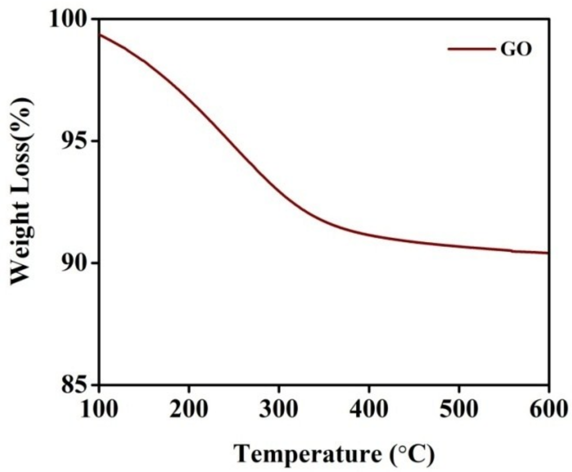

Fig. S5 - TGA spectrum of GO

FTIR Analysis for Hydrogenated Hybrid Nanocomposites

The FTIR spectra of hydrogenated RGO, RGO/h-BN, RGO/A-HNT and RGO/A-HNT/h-BN hybrid nanocomposites are shown in Fig. S5. It resembles the FTIR spectra of as synthesized RGO, RGO/h-BN, RGO/A-HNT and RGO/A-HNT/h-BN hybrid nanocomposites except the overall decrease in intensity.

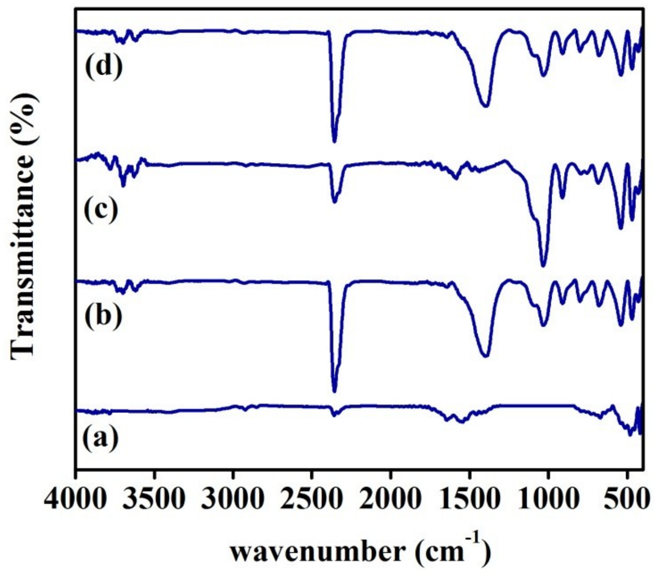

Fig. S6 - FTIR spectra of hydrogenated (a) RGO (b) RGO/h-BN (c) RGO/A-HNT and (d) RGO/A-HNT/h-BN hybrid nanocomposites

References

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Figure captions

Fig. S1 - XRD pattern of GO

Fig. S2 - FTIR spectrum of GO

Fig. S3 - UV/Vis spectra of GO and RGO

Fig. S4 - Elemental mapping images of (a) RGO (b) RGO/h-BN (c) RGO/A-HNT and (d) RGO/A-HNT/h-BN hybrid nanocomposites

Fig. S5 - TGA spectrum of GO

Fig. S6 - FTIR spectra of hydrogenated (a) RGO (b) RGO/h-BN (c) RGO/A-HNT and (d) RGO/A-HNT/h-BN hybrid nanocomposites