Hydrogen-Substituted Graphdiyne Encapsulated Cu_2O Nanowires for Electrochemical Applications

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Hydrogen-substituted Graphdiyne is an sp and sp^2 hybridized carbon allotrope. There are three -C≡C-C≡C- bonds that are bridged in a hexagonal benzene ring and create a 2D planar network structure. This unique atomic arrangement endows many fascinating properties such as abundant chemical bonds, infinite natural pores, highly conjugated structures, electrical conductivity (1.02×10^{-3} S m^{-1}), electron mobility (7.1 x 10^{2} $cm^2V^{-1}S^{-1}$) and stability [1]. Many carbon nanomaterials and their allotropes have proved their potential applications in electrochemical applications. Especially, graphite is the most commercial product for lithium-ion battery anode materials. Further, carbon nanotube, graphene and reduced graphene oxide have been extensively investigated to increase the device performance and a productive layer for electrochemical stability. Recently, highly π-conjugated carbon materials have been attracted due to their excellent conductivity and porosity which is an essential property for metal ion storage [2]. Among those materials, HsGDY is the most suitable material for metal ion storage due to its -C≡C-C≡C- bonds. Meanwhile, the combination of metal oxides with carbon material increases the overall electrochemical stability and ion storage ability. In the present work, HsGDY is synthesized over a Cu_2O nanowire template by the Glaser homo-coupling reaction. The Raman results (Fig.1a) showed a strong peak at 2217 cm^{-1} which corresponds to -C≡C- bonds and a peak at 991 cm^{-1} is the C-H side chain vibrations of HsGDY [3]. The SEM and EDS mapping results proved that the HsGDY was uniformly covered over Cu_2O nanowires with thicknesses of 10, 12 and 16 nm for the reaction time of 6, 9 and 12 hours, respectively. The SEM and EDS mapping results are shown in Fig.1(b and c). The lithium-ion storage and electrochemical performance of the HsGDY will be evaluated.

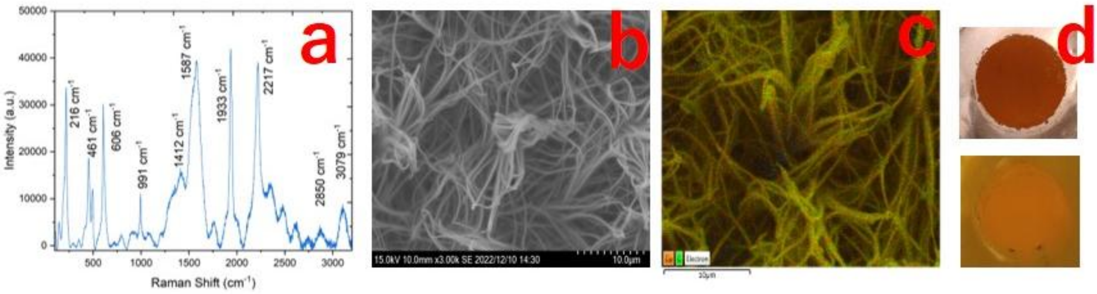

Fig.1 (a) Raman spectrum, b) SEM micrograph and c) EDS mapping of HsGDY@Cu_2O and d) digital photograph of Cu2O and HsGDY@Cu_2O.

References

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