

Manganese Oxide – Graphene Oxide Hybrid Support Materials for Use in Direct Methanol Fuel Cells

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Manganese Oxide – reduced Graphene Oxide ($\text{MnO}_x\text{-GO}$) hybrid supports have promise for improving the performance of direct methanol fuel cells (DMFCs) [1], by improving the durability and stability of the expensive precious metal catalyst currently used in such devices.

MnO_x – GO hybrid materials are highly tuneable, due to the numerous possible oxidation states of manganese, and different morphologies that can be produced.

In this instance, manganese oxide has been grown on graphene oxide via a rapid microwave assisted one pot wet chemical method [2], using multiple different manganese precursors. This relatively 'green' synthesis route uses low energy microwaves and aqueous solvent and also promises facile scale up as it is fast and relatively simple. The resulting materials have varying compositions of between 10 to 50% MnO_x content, as controlled by the synthesis parameters.

These hybrid materials have subsequently been decorated with platinum nanoparticles via a further one pot microwave assisted polyol process, in order to test them for use in DMFCs.

These Pt- $\text{MnO}_x\text{-GO}$ materials have been thoroughly characterised via: thermo-

gravimetric analysis (TGA), X-ray photoelectron spectroscopy (XPS), and transmission electron microscopy (TEM), showing that the MnO_x content in the support affects the growth of platinum nanoparticles.

Ex-situ electrochemical testing has been carried out to determine the material's suitability for use in electrochemical devices. The hybrid $\text{MnO}_x\text{-GO}$ supports produced show promise in improving the tolerance of the platinum catalyst to methanol intermediates.

Figures

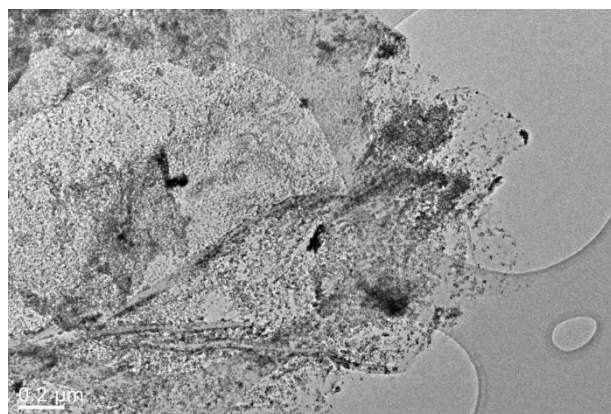


Figure 1: TEM image showing Pt- $\text{MnO}_x\text{-GO}$ sheet.

References

- [1] H. Huang, Journal of Power Sources, 239 (2013) 189-195
- [2] S. Sharma et.al., J Phys Chem C, 34 (2011) 17009-17019