NITROGEN-DOPED NANOCARBONS AS CATALYSTS FOR ELECTROREDUCTION OF OXYGEN

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There is an increasing demand for clean energy in the world and a lot of research is done towards developing and optimising renewable energy conversion devices with low temperature fuel cell being one of the most promising one. The performance of fuel cell is limited by the sluggish kinetics of electrochemical oxygen reduction reaction (ORR) at the cathode. Noble metals (especially platinum) are commonly used as catalysts to improve the kinetics of the ORR. But due to their high cost and scarcity, the search for non-precious metal or metal-free catalysts is in progress. As metal-free catalysts, different heteroatom-doped carbon nanomaterials can be used. Carbon nanomaterials have high surface area, good electrical conductivity and relatively low cost, but also show low electrocatalytic activity towards the ORR, which can be improved by doping with heteroatoms (like N, P, S, B) [1].

Herein, a composite of two nanocarbons, namely multi-walled carbon nanotubes (MWCNT) and carbide-derived carbon (CDC), is made and doped with nitrogen. Previous works from our group have shown that these carbon nanomaterials doped with nitrogen have good electrocatalytic activity towards the ORR [2, 3], so combining the two might give feasible results. The catalysts were synthesised using high temperature pyrolysis of a mixture containing MWCNT, CDC and a nitrogen precursor. Four different nitrogen sources (dicyandiamide, cyanamide, urea and melamine) were used. A rotating disc electrode method was used to assess the catalysts' activity towards the ORR. Physico-chemical characterisation of the catalysts will be done using various surface analytical methods.

References

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