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Microwave-assisted synthesis of palladium-decorated FeCo@Fe/C core-shell: Applications in direct alcohol alkaline fuel cells

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The use of microwave irradiation to tune the physico-chemical properties of inorganic materials has been known for some decades [1]. However, there is a limited literature on the use of microwave irradiation to control the structure, size and electrochemistry of electrocatalysts for fuel cells. One of the research activities of the CSIR Materials Science and Manufacturing involves the application microwave-assisted synthesis to tune the physico-chemical properties of catalytic nanomaterials for fuel cell technologies.

Palladium catalysts are possible replacement for platinum catalysts, especially in direct alcohol alkaline fuel cells (DAAFC). Recently, we introduced a technique called "*microwave-induced top-down nanostructuring and decoration (*MITNAD) for making Pd-based ternary core-shell nanoparticles (FeCo@Fe@Pd/C) with sub-10 nm diameter size [2]. The MITNAD technique simply involves the use of fast microwave irradiation for a one-step top-down nanosizing of large-sized soft magnetic FeCo@Fe/C core-shell material (0.21 – 1.5 μm) to sub-10 nm sized Pd-decorated structure, FeCo@Fe@Pd/C (*ca*. 3 – 7 nm).

The new nanoelectrocatalysts have been tested in DAAFC for the oxidation of several alcohols (methanol, ethanol, ethylene glycol and glycerol) and for oxygen reduction reduction (ORR) in half-cells and single-cells (passive and active). In this presentation, we will show that our proposed microwave-assisted strategy is simple, fast, efficient and, importantly, completely avoids the complications associated with the state-of-the-art strategies for preparing electrocatalysts for fuel cells.

References

1. R. Roy, D. Agrawal, J. Cheng, S. Gedevanishvili, *Nature* 399 (1999) 668
2. O.O. Fashedemi, B. Jules, K.I. Ozoemena, *Chem. Commun.* 49 (2013) 2034