Investigation of Oxygen Reduction on Pt Nanoparticles Deposited onto D-glucose Derived Carbon in Alkaline Media

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Investigation for clean and renewable power sources has been a major technological challenge for several decades. Among them, the fuel cells and batteries have attracted much attention. Numerous carbon materials have been studied to reach the better performance but there are only few results analysing the impact of the highly microporous-mesoporous carbon materials onto oxygen reduction kinetics.

In this study a new type of microporous-mesoporous carbon material, synthesized from D-glucose and post-treated with CO_2, was used as the carbon support for the Pt catalyst and were investigated for electrochemical properties in alkaline media before and after Pt deposition [1, 2].

Prepared unmodified and modified materials were characterized using XRD, Raman spectroscopy, N_2 adsorption/desorption method, HRSEM, SEM-EDX and HRTEM. The cyclic voltammetry, rotating disk electrode and electrochemical impedance spectroscopy (EIS) methods were used to investigate the electrochemical behaviour of the catalysts in 0.1 M KOH solution.

Disordered amorphous structure of the synthesized carbon material C(HTC), spherical shape and good dispersion of the Pt nanoparticles was confirmed by mentioned physical characterization techniques.

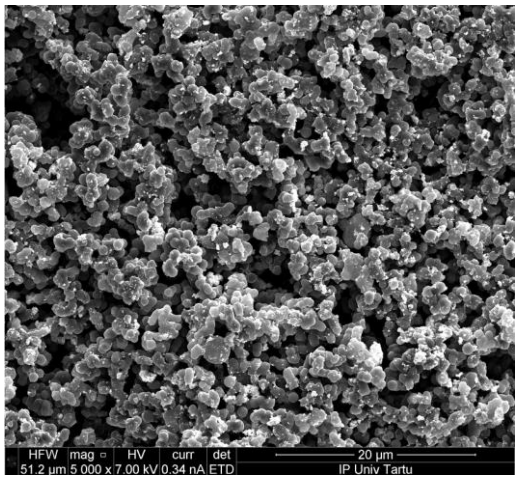

Figure 1: The SEM image of the catalyst material Pt-C(HTC).

The results of electrochemical measurements for the Pt-nanoclusters modified material showed high cathodic current density of −70 A m^{-2}. Compared to the same Pt modified catalysts data in 0.5 M H_2SO_4, higher catalytic activity was determined for the Pt-modified material in alkaline solution [2, 3]. The EIS results confirmed the capacitive behaviour of the samples at low frequencies. Collected results suggest that the materials synthesized could be considered as good cathode materials for alkaline fuel cells.

References

[1] Thomberg, T., et al., Journal of the Electrochemical Society, 160 (2013) A1834-A1841.
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