

Platinum-functionalized CVD Growth Graphene Foam for Fuel Cells Applications

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Abstract

The development of catalysts with high activity for the ORR is essential to proton exchange membrane fuel cells (PEMFCs), since the majority of activation losses occur at the cathode and it turns into an interesting research area. In the present study, it is investigated the hydrothermal platinum functionalization of the CVD grown three-dimensional graphene foam (3D-GrFoam) using three concentrations of dihydrogen hexachloroplatinate (IV) hydrate [1] (Figure 1). The platinum functionalized graphene foam determined from XPS was 0.2 at %, 0.3 at % and 0.4 at %, respectively. The catalytic activity towards ORR was analyzed from linear sweep voltammetry (LSV) plots recorded with a scan rate of 5 mV s⁻¹ in oxygen saturated 0.5 M H₂SO₄. In Figures 1 and in the inset are presented the LSV curves and the Koutecky-Levich (K-L) plots for 0.4PtGrFoam as current density (mA⁻¹ cm²_{geo}) vs. $\omega^{-1/2}$ (rad s⁻¹)^{-1/2}, for various rotation speeds (among 250–1500 rpm) and different potentials (0.1 V-0.8 V). From the fitted K-L plots it is noticed a fair linear relationship at all potentials, that confirms the electroreduction of platinum. The number of transferred electrons is between 3.22 to 3.59 indicating the preponderance of the four-electron transfer mechanism in the ORR corresponding to the directly reduction of O₂ to H₂O.

References

- [1] D. Ion-Ebrasu, R.D. Andrei, S. Enache, S. Caprarescu, C. C. Negri, C. Jianu, A. Enache, I. Boerasu, E. Carcadea, M. Varlam, B. S. Vasile, J. Ren, *Materials* **2021**, 14, 4952.

Figures

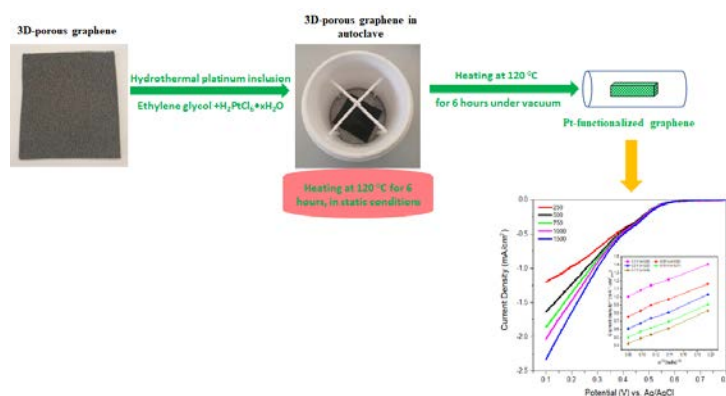


Figure 1: Scheme of the hydrothermal platinum functionalization of the 3D-porous graphene foam