SYNTHESIS AND ELECTROCHEMICAL ACTIVITY OF THE PLATINUM-SUPPORTED CATALYSTS FOR OXYGEN REDUCTION REACTION

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As the demand for alternative power sources grows, fuel cells (FCs) are emerging as promising options for zero-emission power. However, the development of highly active and durable catalysts is crucial to improve their efficiency. Platinum is one of the most popular catalysts for proton exchange membrane FCs, but its high cost and scarcity make it necessary to increase its utilization and activity. One way to achieve this is by increasing the active surface area of platinum through the preparation of nanoparticles and dispersing them on support surfaces. However, this approach presents a challenge as the supports must remain stable under the working electrochemical potentials. Thus, finding more electrochemically stable supports is a pressing issue today.

In our work, Pt nanoparticles were deposited on carbon-based nanotubes by hydrothermal method using ethylene glycol (EG) as the reducing agent (Fig.1, a). The size of the Pt nanoparticles is in the range of 3 to 6 nm. The stability of the nanotubes under electrochemical potential during 5000 cycles (Fig.1, b), and their activity in the oxygen reduction reaction (ORR) in electrochemical half-cells before and after cycling were investigated.

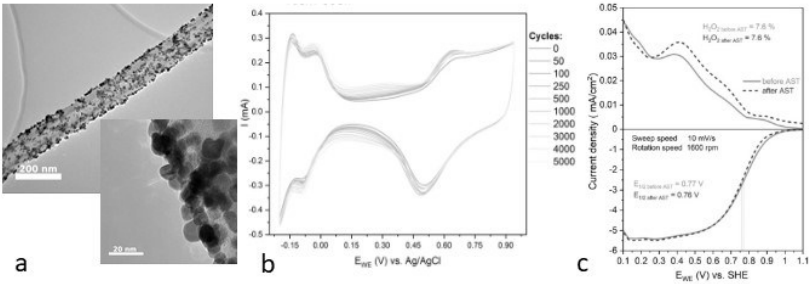

Fig. 1. The TEM images (a), cyclic voltammetry (CV), and oxygen reduction reactions curves (ORR) of Pt nanoparticles, deposited on CNT-COOH

The slight increase of the electrochemically active surface area during the cycling could be connected with the oxidation of the impurities during the electrochemical reaction. The Pt nanoparticles demonstrate high activity in ORR. The main reaction goes through $4e^-$ pathway with H_2O formation. However, in the potential range from 0.15 to 0.65 V, a negligible amount of H_2O_2 is produced. After an accelerated stress test the half-wave potential ($E_{1/2}$) almost does not change, which indicates the stability of the nanoparticles in ORR.