Pt nanolayers were sputter-deposited onto multi-walled carbon nanotubes (MWCNT). Pt nanoparticle/MWCNT composites were used as catalysts for oxygen reduction reaction (ORR). Magnetron sputtering has a number of advantages over other physical methods, such as ease of sputtering any metal, alloy or compound onto different substrates providing high-purity films, good adhesion on substrate with accurate control of metal loading [1]. Although the method is convenient, it is not frequently utilized in fuel cell catalyst preparation. Nevertheless, this method enjoys an increasing interest within both AEMFC and PEMFC communities [2]. The purpose of this work was to perform a systematic investigation for optimizing the use of the magnetron sputtering technique for the preparation of electrocatalytically active PtNP/MWCNT nanocomposite materials.

Anchoring of Pt nanolayers of different catalyst loading onto MWCNT support was performed by sputter-deposition with a Pt target in argon atmosphere. The nominal Pt film thicknesses were 4, 8 and 16 nm. In what follows, the prepared catalysts are designated as 1-PtNP/MWCNT, 2-PtNP/MWCNT and 3-PtNP/MWCNT, respectively. The CO oxidation experiments and cyclic voltammetry were used for cleaning and characterizing the surface of PtNPs attached to carbon nanotubes.

The rotating disk electrode (RDE) experiments were performed in O2-saturated 0.5 M H2SO4 and 0.1 M KOH solutions in order to test the electrocatalytic properties of PtNP/MWCNT catalysts. The composite catalyst samples were characterized by scanning electron microscopy (SEM) and X-ray diffraction (XRD). SEM micrographs show an excellent distribution of the PtNPs on the surface of MWCNTs (Fig. 1).

In order to confirm activity trends the ORR was also studied in alkaline media. The half-wave potentials of O2 reduction in 0.1 M KOH were higher than in 0.5 M H2SO4, and this is the expected results considering the inhibiting effect of strongly adsorbed (bi)sulfate anions. The SA values of PtNP/MWCNT catalysts in 0.1 M KOH were comparable with that of bulk Pt. The Tafel behavior of O2 reduction was also similar for these electrodes.