# Performance Study of Carbon Supported Co@Pt/C Core-Shell Nanocatalyst for Oxygen Reduction Reaction in a PEMFC

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## ABSTRACT

In this study carbon supported Co-Pt core-shell nanocatalysts, with different Co:Pt ratio, were synthesized and characterized for evaluating their performances in a rotating disk electrode (RDE) setup, and in membrane electrode assemblies (MEAs) configuration, for the oxygen reduction reaction (ORR). In first instance Co cores were obtained from the chemical reduction of $CoCl_2$ with $NaBH_4$ using TBAB as surfactant and in an ultrasound probe system. Subsequently through a galvanic displacement process Co atoms were replaced by Pt atoms to make a shell. TEM and SEM analysis have showed highly dispersed nanoparticles with size averaged between 4-10 nm. XRD diffractograms showed peaks related to Pt phase little shifted to higher angles compared with pure Pt nanoparticles used as reference. Electrochemical results don't show Co phase segregation, which is characterized by the presence of a wide peak around 0.4 V/RHE, during the first cycle. Results of RDE show that both catalysts presented superior current density, of at least three folds of specific activity than that of commercial 20% Pt/C Etek® catalyst, however the mass activity is still below obtained by the commercial catalyst, which we must continue to work in order to eradicate this problem attributed to agglomeration of nanoparticles. The catalyst with higher specific activity was selected for preparing a membrane electrode assembly (MEA) and their performance evaluated in a PEM single cell. Optimization of catalytic materials loading was carried out and final results showed superior performance in mW/mg Pt to commercial catalysts. The SEM analysis showed that MEAs of more porous films provide higher performance compared to the most compact films.

***Keywords:*** Synthesis of Co@Pt /C; Oxygen reduction reaction; Membrane electrode assembly.

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