

## Mechanistic Studies on Fe-PEI Derived non-PGM Catalysts for Oxygen Reduction

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Recently substantial progress in development of non-PGM catalysts for oxygen reduction was reported [1, 2]. The activity and durability of those materials in both RDE and MEA tests approached ~40% of the Pt/C values. However, in order to further improve non-PGM ORR catalyst the deeper understanding the nature of active sites as well as mechanism of oxygen reduction is required. Recently, UNM group published synthesis of Fe-PEI catalyst by sacrificial support method (SSM) [3]. Later it was shown that SSM is flexible method and can be used for synthesis of different materials for energy applications [3-10].

Herein, we report the detailed mechanistic studies on Fe-PEI derived catalyst synthesized by conventional method. The catalysts were prepared by wet impregnation of iron and PEI precursors onto the surface of carbon material, followed by high temperature pyrolysis in inert atmosphere.

The morphology of Fe-PEI catalyst is shown on Figure 1.

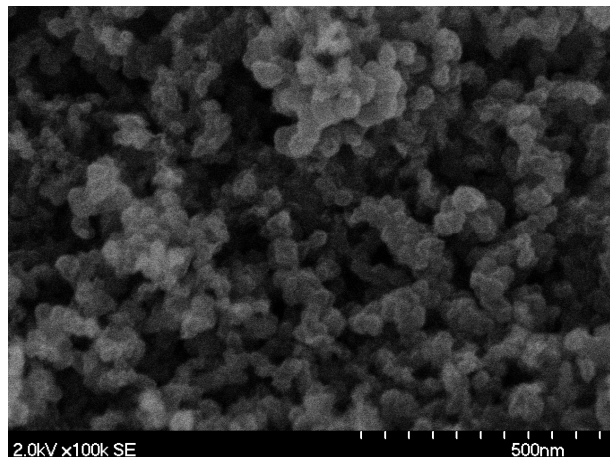


Figure 1. SEM image of Fe-PEI catalyst.

Electrocatalytic activity was studied in both acidic and alkaline media. The dependence of the overall number of electrons on catalyst loading on the working electrode was studied by RRDE technique. The ORR performance of Fe-PEI-1 catalyst in acid is shown on Figure 2.

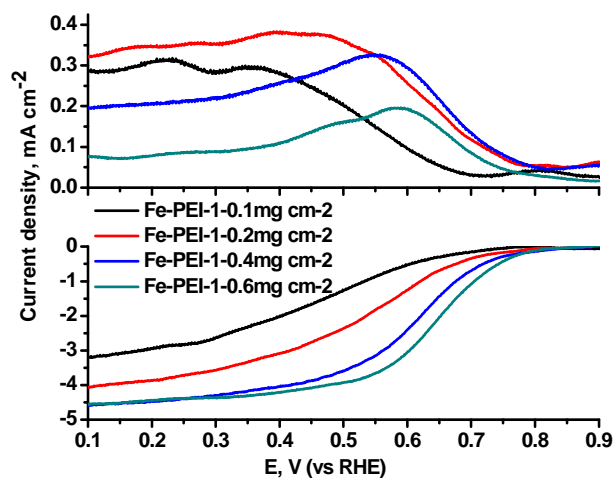


Figure 2. RRDE data on Fe-PEI-1 catalyst in 0.5M H<sub>2</sub>SO<sub>4</sub>.

The overall number of electrons participating in ORR linearly depends on loading of catalyst and varies between 3.5 and 3.9e<sup>-</sup>.

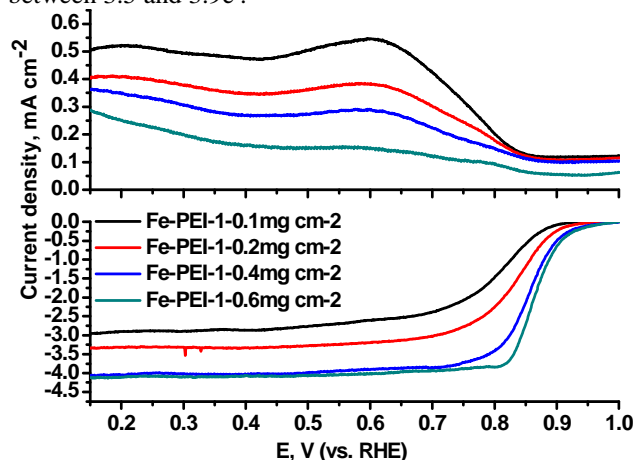


Figure 3. RRDE data on Fe-PEI-1 catalyst in 1M KOH.

It was observed that Fe-PEI catalysts performed substantially better in alkaline media compared to acid one (Fig. 3). The  $E_{1/2}$  in alkaline was found to be close to Pt/C values. The difference of ORR activity in acid and alkaline is direct indication of dependence of mechanism on pH. The experiments on correlation between surface chemistry of Fe-PEI catalysts with their performance are ongoing

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