Determination of H_2O_2 Formed During Oxygen Reduction on High Surface Area Pt/C Catalysts

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Hydrogen peroxide formed as a result of incomplete oxygen reduction is suspected of degrading the performance of polymer electrolyte membrane fuel cells. The objective of this study is to investigate the effects of Pt loading and the type of carbon support on the catalytic activity of carbon supported Pt for oxygen reduction in acidic solution. A thin-film rotating ring-disk electrode (RRDE) was used to determine the kinetic parameters and the fraction of hydrogen peroxide production as compared with those obtained for polycrystalline platinum disc [1, 2].

Catalysts samples with varying Pt content (20%-50%) on the same carbon support were analyzed. RRDE experiments were also done on 50% Pt on carbon supports with varying surface area (100-500 m^2/g). Typical disk and ring current sweeps in the negative direction for different rotation speeds are shown in Figure 1. The production of peroxide was least was polycrystalline platinum, and increased for Pt/C catalysts with the decrease in the Pt wt%.

High surface area carbon, used as support for Pt/C catalysts is seen to produce substantial amounts of H_2O_2 at potentials negative to 0.7 V (vs RHE) [3].Experiments were performed with carbon support in thin film. The amount of peroxide which is oxidized by the platinum in the catalyst particles was determined by carrying out experiments with the same carbon loading, varying the platinum loading. The hydrogen peroxide production was obtained as a function of the Pt loading.

Acknowledgement:

References:

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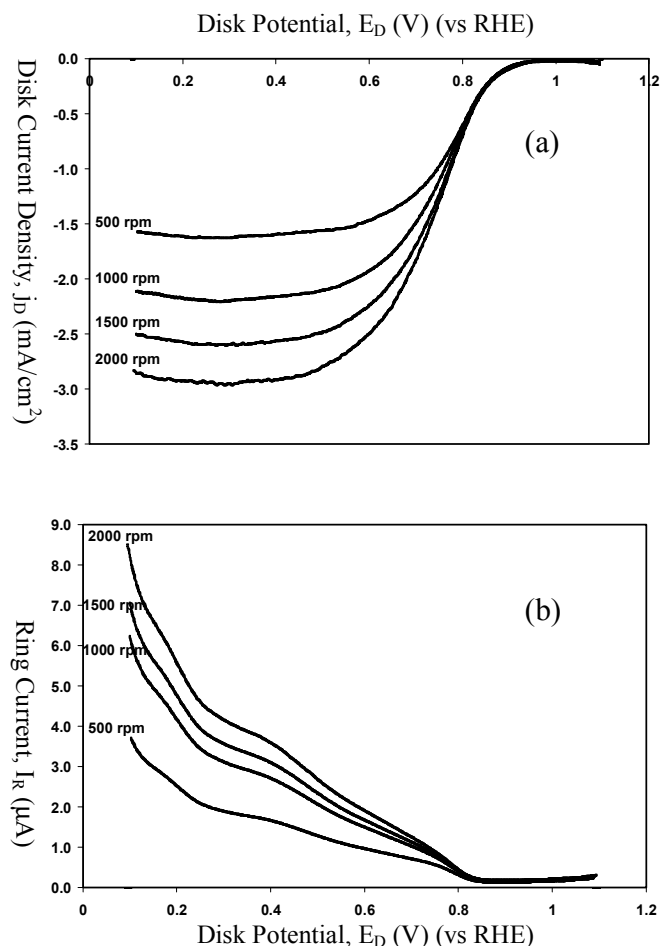3. O. Antoine & R. Durand, J. Appl. Electrochem., 30, 839 (2000).

Figure 1: (a) Current-potential curves for O_2 reduction on 40% Pt/C catalyst in a thin film; (b) peroxide re-oxidation on Pt ring electrode in 0.5 M H_2SO_4 saturated with pure O_2. $E_R = 1.15$ V (vs RHE). Scan rate: 10.2 mV/s.