64-Channel Fuel Cell For Testing Sputtered Combinatorial Arrays Of Oxygen Reduction Catalysts

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Platinum[1] and platinum-based alloys[2] have long been recognized as highly efficient catalysts for low temperature oxygen reduction. Given the high cost of platinum and the impact of this cost on the economics of fuel cell commercialization, many groups are actively researching the catalytic activity of different alloy compositions. Typically catalytic fuel cell performance is measured in 50cm^2 test cells, one composition at a time.

As this research moves towards studying binary, ternary and maybe even higher order compositions, the number of candidate materials for testing increases dramatically. Under such circumstances, the application of combinatorial materials science can dramatically increase the number of compositions assessed in a given timeframe.

This presentation will outline the capabilities of Dalhousie University's fuel cell catalyst combinatorial infrastructure with strong emphasis on the design and validation of a 64-channel proton exchange membrane fuel cell. It will be shown how this infrastructure is being used to measure the performance of compositional arrays of oxygen reduction catalysts under "real world" conditions.

As an example of these capabilities, Figure 1 shows cyclic voltammograms (CVs) measured for all 64 channels of a sputtered film with a constant platinum loading at each channel. The measurement conditions are indicated in the figure description. These data show excellent channel to channel repeatability, with all channels showing CV features typical for nano-particulate platinum.

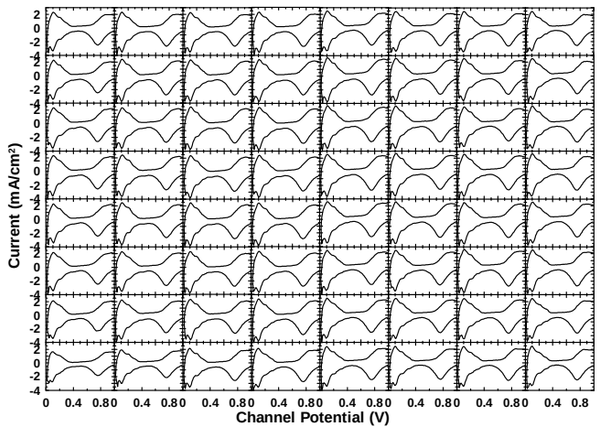

Figure 1: CVs measured on a 64 channel array of sputtered dots, all with the same platinum loading. The CVs were measured at 100 mV/s at room temperature with humidified argon flow over the cathode array and hydrogen over the anode. The anode is a continuous coating of platinum-loaded carbon in Nafion on carbon paper.

References.

[1] J. Larminie and A. Dicks, *Fuel Cell Systems Explained*, p. 66, John Wiley & Sons, New York (2002).
[2] P. Costamagna and S. Srinivasan, J. Power Sources, 102 (2), 242-252 (2001).