Novel Quinone-Based Couples for Flow Batteries

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Flow batteries are of interest for low-cost grid-scale electrical energy storage in the face of rising electricity production from intermittent renewables like wind and solar.

We will report on investigations of redox couples based on the reversible protonation of small organic molecules called quinones. These molecules can be very inexpensive and may therefore offer a low cost per kWh of electrical energy storage. Furthermore they are known to rapidly undergo oxidation and reduction with high reversibility under some conditions, suggesting the possibility of high current density operation, which could lead to low cost per kW.

We will report half-cell measurements of current density vs. potential for various quinones and hydroquinones in low pH aqueous solution, facilitated by a variety of electrocatalysts. For a subset of these we will report full fuel cell measurements as well, where current densities in excess of 240 mA cm^{-2} have been achieved to date.

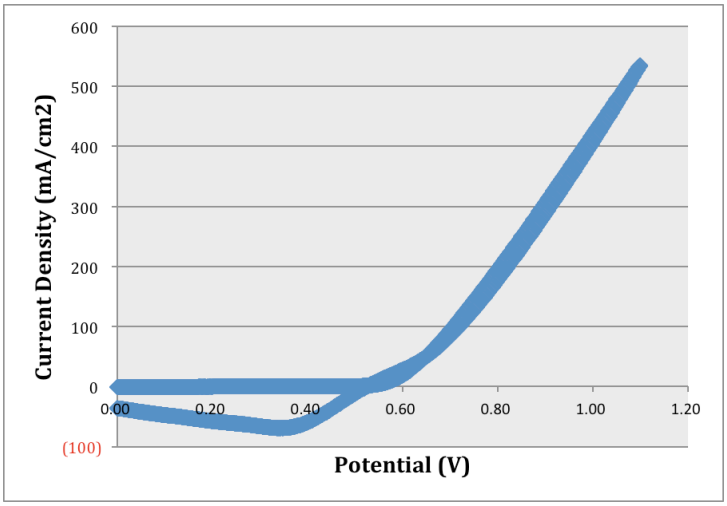

Figure 1: Oxidation of 3.91 M catechol in 1 N H_2SO_4 at 20 °C on a Pt working electrode, vs Ag/AgCl, with a large Pt counter electrode, 250 mV/s sweep rate.