Modeling CO poisoning and O_2 bleeding in PEM Fuel Cells

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CO is one of the trace components in hydrogen fuel which is produced from hydrocarbon reforming process. CO can adsorb at Pt surface due to its special molecular structure and thus blocks the access of new reactant molecules to the surface active centers. Therefore, CO is a severe poison to Pt catalyst in PEM fuel cells; it reduces fuel cell performance significantly even at levels of 1-10 ppm. A fuel cell which would be useful for commercial applications would preferably be tolerant of CO levels at 100 ppm or greater. There are several ways to mitigate the CO-poisoning. Researchers have been able to formulate more tolerant catalysts by adding metals like ruthenium to the platinum [1]. A second option is to operate fuel cell at higher temperature such as 120 ^{0}C [2]. Bleeding a trace of O_2 into anode fuel flow is the another method to reduce CO poisoning [3].

A multi-resolution [4,5] mathematical transient model of a PEM fuel cell anode catalyst layer has been developed in this study. Adsorption, desorption and electro-oxidation of carbon monoxide and hydrogen, as well as the heterogeneous oxidation of carbon monoxide and hydrogen with oxygen are modeled to simulate CO poisoning and oxygen bleeding.

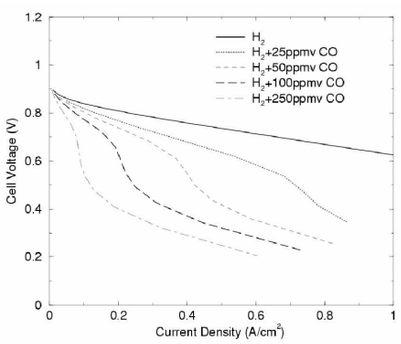

Figure 1. Influence of CO concentrations on PEMFC performance.

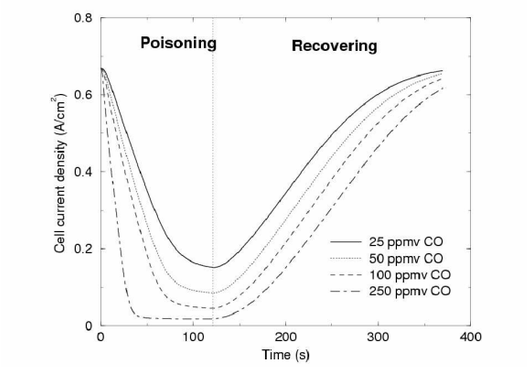

Figure 2. CO poisoning and recovery process over a PEM fuel cell

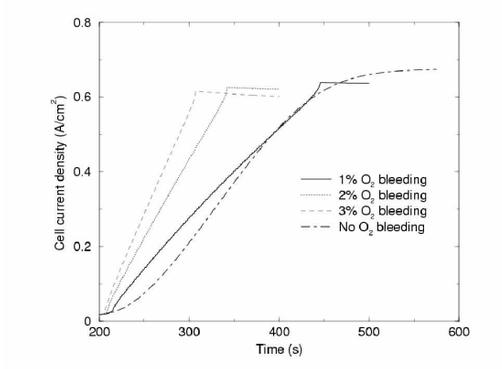

Figure 3. Effects of O_2 bleeding on PEMFC performance

Reference

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