Analysis of Carbon Corrosion in a Proton Exchange Membrane Fuel Cell

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Carbon corrosion in the cathode catalyst layer (CCL) is a major degradation source in a proton exchange membrane fuel cell (PEMFC). Especially, in case of fuel starvation or start-up/shut-off procedure, severe carbon corrosion occurs due to high electrode potential over 1.4 V in the CCLs. In this paper, a two-dimensional, non-isothermal, computational fluid dynamics (CFD) model is implemented by commercial CFD package, Fluent®. The present model was formulated by considering direct oxidation reaction when hydrogen and oxygen molecules meet to account additional water generation in both anode and cathode catalyst layers. Main objective was to analyze influences of H_2/O_2 front on carbon corrosion rate. Various situations, including along-the-channel fuel starvation and dead-end anode operation, were considered to provide optimized conditions for different operation modes. The simulated results have shown acceptable agreement with experimental in-situ observations from other literatures.