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Effect of Operating Parameters and Contaminant Feed Rate on PEMFCs Contamination from Polyglycol Dimethacrylate based Assembly Aids

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The main challenges for commercialization of fuel cells are cost and durability. Using off-the-shelf materials for system components in Proton Exchange Membrane Fuel Cells (PEMFCs) may lower the cost provided they do not compromise function, fuel cell performance, or life time. The purpose of this paper is to increase the understanding of contamination effects from materials used in fuel cell systems. The study investigates how different operating parameters may contribute to the observed performance effects. This requires an understanding of single cell performance under a range of operating conditions and feed rates of contaminant leachate to understand the mechanisms of contamination. As such, it adds to the relatively limited database of possible PEMFC contaminants that originate from the fuel cell system itself (1-6).

In the example data shown here, we present the performance effect of a polyglycol dimethacrylate based assembly aid. The leachate solution was obtained by soaking the materials in DI water at 90°C for one week. The total organic carbon (TOC), solution conductivity were measured 750 ppm and 208 ms/cm respectively. Advanced analytical analysis FTIR, ICP, IC, GCMS, and LCMS was performed to identify and quantify the organic and inorganic species present in the leachates. It is not known *a-prior* if these species contribute to the performance loss during fuel cell operation.

This work is the extension of a previously presented study during which twenty assembly aids materials were screened for their performance impact (7). A nebulizer is used to infuse the contaminant solution into the cathode side of a fuel cell operating at different operating conditions. The voltage decay and the high frequency resistance (HFR) are measured over time as shown in Figure 1. As the data show, increasing the relative humidity results in reduced performance degradation due to contamination from the material. Polarization curves and Pt cyclic voltammograms of the cathode were measured before and after contaminant infusion to determine the performance loss as well as the electrochemical surface area change of the cathode. Detailed results of a quantitative characterization technique will be presented that allows determination of the performance impact at the catalyst, the ionomer in the electrode, and the membrane.

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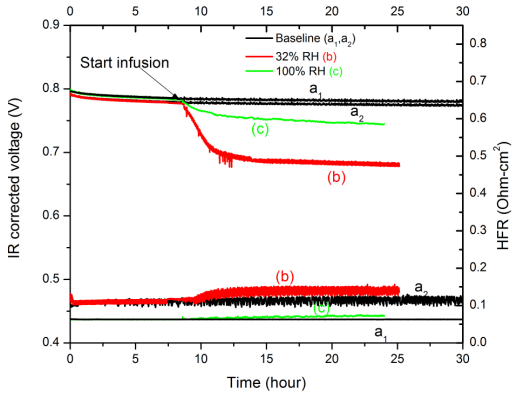

Fig.1. Comparison of IR corrected cell voltage response from contaminatin of Loctite®567 leachate infusion with different %RH: (a_1) Baseline with DI water with 100%RH, : (a_2) Baseline with DI water with 32%RH (b) Contaminant infusion with 32% RH, (c) Contaminant infusin with 100% RH.

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