Leaching studies of assembly aids for balance of plant of PEM fuel cells

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Study of the deteriorative effect of contaminants on a system performance is important for its design. The choice of balance of plant (BOP) materials will straightly influence on the cost of PEM fuel cells [1]. Thus the studies have been rigorously conducted for years [1~7]. The effects have been analyzed by both in-situ and ex-situ techniques. The leaching rates of materials such as assembly aids have been also studied, and it has been presented that the amount and its composition depend on the materials [2].

For examples according to their study for assembly aids, there has been a trend that almost no organic or inorganic compounds have been leached out from fluorocarbon type materials though the other urethane, silicone, and epoxy type materials have had more compounds in soaking water. In the soaking water in urethane type assembly aids, among six different materials, the TOC has varied more than ten times from 100ppm to 1800ppm. Some organic compounds have been identified as methyl diamine, diethyl glycol monoethyl ether acetate, diethyl glycol monoethyl ether, benzyl alcohol in those urethane's solutions. But the ratio of these compounds in the solution has varied from different materials [2].

In this presentation, we have studied the leaching rates of six assembly aids with different protocols. The materials was coated on Teflon sheet and soaked in DI water. TOC, pH, and solution conductivity has been measured. The results indicate that the extraction rate of organic or inorganic compounds depends on the materials.

In Figure 1, the number from 50A01 to 50A06 represents the solutions where different assembly aid materials have been soaked. The difference between Sets A and C is the protocol of soaking. For both sets, total volume of solutions was always the same. However, in Set A, only small volume of the soaking water has been replaced with new DI water at each stated date though in Set C, whole solution has been replaced with new DI water at each stated date. As shown in Figure 1, although all six tested assembly aids seem to become at the equilibrated state in two days in the test of Set A, leaching of some compounds from Set C was also observed continuously after two days. We assume the decrease of pH for 50A03 might be caused by permeation of carbon dioxide through the bottle since TOC and solution conductivity of Set A did not change much. (The data is not shown in this abstract.) There were two trends. One trend was like the result of 50A04 and 50A05 solutions in which all compounds would leach out in two days and only less of compounds would come out after the date. (The pH would come or stay close to pH=7, and the conductivity would go close to zero.) For BOP, these two materials are better than the other four. The other four assembly aids may continuously release contaminants to the FC system if they will be used in the system.

We will continue this study and will provide the analysis to discuss how these two trends could be determined. The behavior of each compounds how to leach out might be affected by the other compounds, and combination effect might exist. The data may include GCMS and ICP-MS analysis, and the pH might be one key for the understanding.

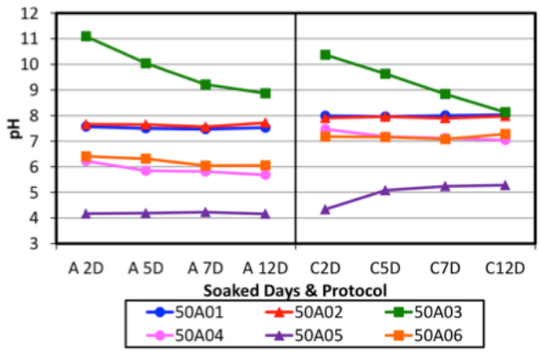

Figure 1: Comparison of pH changes for Sets A & C of leaching solutions from six assembly aids.

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