Studying the poisoning effect of an assembly aids material and relating it to the species found in the material leachate

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System-derived contaminants have been shown to affect the performance and durability of fuel cell systems; hence it is important to minimize contamination related losses. In addition, lowering the cost of the balance of plant (BOP) components has risen in importance, with the decrease in the cost of stack materials. In order to decrease the overall cost of the automotive and stationary fuel cell systems and make them as competitive as possible, low-cost system component materials that provide similar function, performance and durability are needed.

There are many prospective BOP materials that can be used in fuel cell systems. The prioritization of the materials to be studied was based on wetted surface area, total mass-to-volume ratio, proximity to MEAs, function, cost, and performance implications. Families of material chosen for the study include structural materials, elastomers for seals and (sub)gaskets, and assembly aids (adhesives, lubricants). Furthermore, different grades of BOP materials, containing different polymer resin grades and additives from different manufacturers were selected for our study.

The contaminants can come from the parent polymer material or the materials that were added to provide specific physical properties, such as glass fiber for structural reinforcement. Hence, it is important to determine what species leached from the BOP materials, the origin of the contaminating species, their impact on fuel cell performance, and whether the contaminating species can be removed or substituted. These results would help the fuel cell industry in selecting appropriate BOP material for fuel cell applications.

To quantify the impact of system contaminants on fuel cell performance, many prospective BOP materials were screened, using a suite of *ex-situ* and *in-situ* techniques [1-7]. The materials were aged in DI water at 90ºC for 1 or 6 weeks. The liquid phase, extractions were analytically characterized by gas chromatography-mass spectrometry (GCMS), total organic carbon (TOC), inductively coupled plasma (ICP), solution conductivity, and ion chromatography (IC) to identify and quantify the species that leached out of the BOP materials. Their effect on catalyst performance and membrane conductivity were studied *ex-situ* and compared with the *in-situ* fuel cell results.

This talk will focus on understanding the poisoning effect of one assembly aids material and how that relates to the effect of two constituents found in the liquid phase leachate. Bostik® 920 fast set is a urethane-based Marine® adhesive/seal. GCMS and IC analyses of the liquid phase extract showed two major species present: p-toluenesulfonamide, and 0.8 ppm of chloride ion. *Ex-situ* electrochemical measurements were performed to determine the poisoning effect of the leachate and the individual components on the electrochemical surface area (ECA) and oxygen reduction reaction activity. Figure 1 shows that the loss in ECA observed for the various dilutions of the leachate from the Bostik® 920 Fast Set solution is likely due to the organic compound, p-toluenesulfonamide. Other results will be discussed.

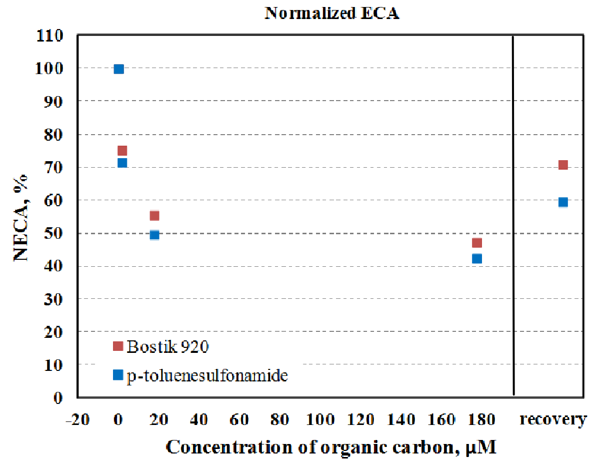

Figure 1: Plot showing that the normalized electrochemical surface area (NECA) and its trend with organic carbon concentration for the Bostik® 920 Fast Set leached solution is similar to the organic compound, p-toluenesulfonamide.

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