A Study of the Impact of Bipolar Plate Material Choices on Portable Fuel Cell Performance and Economy

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Commercialization of fuel cells has become increasingly important over the past several years. One of the major obstacles facing potential fuel cell manufacturers is quality and cost of raw materials (1). While much effort has focused on membrane and catalyst cost factors, the work that has been done regarding other fuel cell stack components has been more limited. The selection of appropriate materials used to form the bipolar plates of a stack can have significant impact on stack cost, performance, and longevity.

Several bipolar plate materials characteristics are of key importance with regards to fuel cell operations and economy. Specifically, attributes such as conductivity, permeability, production cost, mechanical strength, corrosion resistance, and mass are critical to production of bipolar plates for portable fuel cell stacks[1].

This work will study the cost and traits of various graphite-based bipolar plate materials. Metal bipolar plate materials are not included due to their high mass and the likelihood of corrosion (2-3). Some of these materials are commercially available today, while LANL personnel have customized others to improve their characteristics.

Mainly, the focus will be on conductivity and a given material's contribution to overall cell resistance. To characterize each material's conductivity, four-point probe and through-plane conductivity analyses are used. **Figure 1** shows the variation in the resistance contribution of various bipolar plate materials with respect to compression.

From an economic perspective, manufacturing and feature formation methods for the materials are extremely important. Possible manufacturing methods for the various materials will be explored. Potentially critical fabrication tolerances, such as reactant channel dimensions (4) will be identified and considered with fabrication limitations in mind.

As the bipolar plate material in question may be intended for use in either hydrogen or direct methanol fuel cells, an examination of each material's ion content and leaching characteristics will be executed under appropriate conditions.

Finally, stack design features that may potentially affect interfacial resistance characteristics of bipolar plate materials will be discussed.

References

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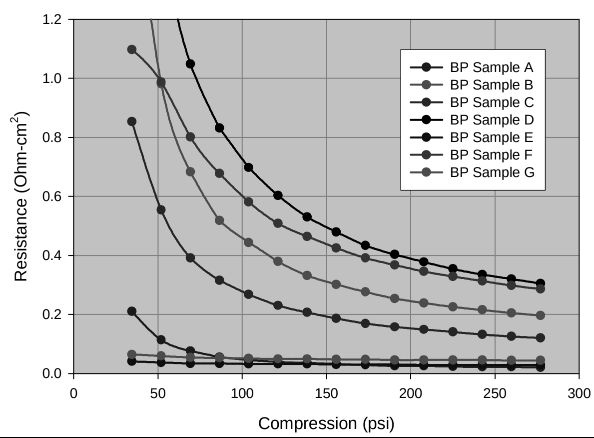

Figure 1. Through-plane resistance vs. compression for several bipolar plate sample materials.