



PolyFuel Breakthrough Makes High Performance Portable Fuel Cells Easier to Manufacture

PolyFuel Inc., the leader in engineered membranes for fuel cells, today announced a new version of its hydrocarbon membrane for portable applications that provides fuel cell manufacturers with the best in class performance attributes of its predecessor, while at the same time providing significantly greater manufacturing flexibility. This is the first hydrocarbon fuel cell membrane that is a “drop-in” replacement for fluorocarbon membranes such as DuPont’s Nafion® in existing fuel cell membrane electrode assembly (MEA) manufacturing processes.

“Widespread adoption of fuel cells, and their long-term commercial viability, depends heavily on their rate of adoption in the power-hungry portable market,” said Jim Balcom, PolyFuel’s president and CEO. “Of the several critical problems to be solved, manufacturability remains high on the list. This introduction addresses that issue for the new generation of high-performing hydrocarbon fuel cell membranes.”

While not yet commercially available, portable fuel cells are the subject of increasingly widespread research and development activity, with huge investments being made by a significant number of companies. Virtually all of that investment has revolved around fuel cell membranes based upon fluorocarbon technology, pioneered by DuPont with the development of their Nafion material in the 1960s, which, although not able to deliver the performance required for commercially-viable portable fuel cells, has, historically speaking, been the only game in town.

A year ago, PolyFuel announced the world’s first commercial hydrocarbonbased membrane for portable direct methanol fuel cells (DMFC). Balcom explained that hydrocarbon membranes offer several substantive advantages over fluorocarbon membranes, particularly in reducing the size, weight and cost and increasing the runtime of portable fuel cell systems. However they also, until today, have typically required different approaches in manufacturing than those used to fabricate fuel cells from fluorocarbon membranes. “With PolyFuel’s new membrane, that is no longer the case,” Balcom said. “Fuel cell manufacturers can now utilize our new membrane as a drop-in replacement for Nafion or other fluorocarbon membranes in their existing MEA fabrication processes.”

Some Like It Hot

Fuel cell membranes – which resemble sheets of cellophane – are literally the heart of a fuel cell. As a result of their uniquely-engineered structure and chemical composition, they are able to produce electricity by stripping electrons from fuel molecules. The only byproduct is water, and for portable fuel cells that use methanol as a fuel, carbon dioxide.

During the manufacture of such a cell, a multi-layer sandwich of membrane and other materials – called an MEA, for “membrane-electrode assembly” – must be fabricated. The MEA acts as a rigid barrier inside the fuel cell separating the wet fuel on one side, and the air on the other, while simultaneously keeping the membrane in contact with both. An MEA in a fuel cell intended for a cell phone would be the size of a business card, and about as thick as a credit card.

Because of the innate plastic characteristics of Nafion and other fluorocarbon membranes, they soften at relatively low temperatures, which has allowed the development of MEA fabrication techniques where the membrane is “hot bonded” to the adjacent components. Hydrocarbon membranes, which are typically

stronger and more durable, have not lent themselves to this technique, as they don't soften at the same low temperatures as fluorocarbon membranes.

PolyFuel's new "hot-bondable" membrane, however, permits manufacturers to effectively "drop in" the more desirable hydrocarbon membrane into fabrication processes originally designed for Nafion.

"This is an important announcement for PolyFuel and a significant development for the industry," commented John Appleby, of Texas A&M University's Center for Electrochemical Systems & Hydrogen Research, and author of The Fuel Cell Handbook, 4th Edition. "Substantial investment and momentum have built up around developing high-volume, low-cost MEA fabrication processes, and having a hydrocarbon membrane that can simply be substituted in for fluorocarbon will garner a high degree of interest."

About the New Membrane

PolyFuel's original breakthrough hydrocarbon membrane, and this new hotbondable version, have been engineered specifically for portable fuel cell applications. The hydrocarbon polymer is designed to be uniquely durable in the presence of methanol, the most commonly used fuel for portable fuel cells. Additionally, the membrane properties have been optimized for high performance and high fuel efficiency. This allows portable fuel cell manufacturers to design fuel cell systems that are smaller, lighter and less expensive – while at the same time being more robust and delivering longer runtimes – compared to systems incorporating conventional fluorocarbon materials such as Nafion.

The hot-bondable version results from a proprietary surface modification. With this modification, the membrane behaves in a fashion similar to Nafion during the bonding or MEA fabrication process, while still retaining the underlying advantages of the original PolyFuel hydrocarbon membrane.

About the Micro-Power Fuel Cell Market

Unlike the application of fuel cells to higher power applications, such as automotive use, where a trillion-dollar global infrastructure is required to distribute hydrogen fuel as widely as gasoline is today, and where lifetimes are still too short and costs per kilowatt are still too high, the so-called "micro-portable" fuel cell market is real, and viable today – particularly with high performance hydrocarbon membranes. Fuel cell system costs are already in the right range, consumers are clamoring for longer run times on their portable devices, and manufacturers are building increasingly power-hungry applications such as wireless connectivity in notebooks, and full-motion video into cell phones. Moreover, the fuel infrastructure is trivial, particularly after the recent decision by the U.N. Committee of Experts for the Transportation of Dangerous Goods that has set the stage for the carriage of methanol fuel cartridges on commercial aircraft.

Such fuel cartridges, resembling disposable cigarette lighters, will, in the notto-distant future, be available in every convenience store and market – which explains why companies such as BIC and Tokai are very active in methanol fuel cartridge development. "Fuel cells are the only viable technology for portable devices to deliver all of the capabilities consumers desire, (and Moore's Law is making possible)," said Balcom. According to PolyFuel estimates based on input from Frost & Sullivan and ABI Research, the market for micro-power direct methanol fuel cells will be over 140 million units in 2012.

PolyFuel's first DMFC hydrocarbon membrane is actively being evaluated by virtually all of the leading fuel cell manufacturers worldwide, and is in use in pilot projects at many, reported Balcom. "A hot-bondable version has been a popular request," he said, "so we engineered one."

PolyFuel also has developed hydrocarbon membrane chemistry for fuel cells – such as those intended for use in automobiles – that use hydrogen as a fuel, rather than methanol.

<http://www.polyfuel.com>

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