



Advanced Coatings for Fuel Cell Technology

Research on advanced coatings at EMSL may help accelerate the development and commercialization of low-cost solid oxide fuel cells (SOFCs). SOFCs will be instrumental in reducing the nation's dependence on imported oil, mitigating environmental concerns associated with current methods of generating electricity from fossil fuels, and providing a bridge to a hydrogen future.

An outstanding problem in SOFC construction is the corrosion of the bipolar steel plate that serves as the current interconnect between adjacent cells of the SOFC stack. "The steel plate is subject to extreme corrosion at high (800°C) temperatures and exposure to a gaseous environment that includes oxygen, hydrogen and steam," says Richard Smith, a professor at Montana State University who is collaborating with EMSL researchers Theva Thevuthasan and Shutta Shutthanandan.

Smith, along with industrial partner Arcomac Surface Engineering, is looking at coatings on the steel plate as a possible solution to the corrosion problem. According to Smith, the coatings are deposited using the filtered arc process, an approach that has been demonstrated to scale up nicely for industrial large-scale applications.

At EMSL's Ion Beam Laboratory, Smith and his colleagues characterized the oxidation of bipolar SOFC plates using nuclear reaction analysis and ion backscattering techniques. "We're investigating the use of filtered-arc thin film deposition technology to produce oxidation resistant coated steel surfaces that maintain low electrical resistivity at 800°C in air," Smith says. "The interconnect must retain low electrical resistance throughout the lifetime of the fuel cell in order to operate properly."

According to Smith, EMSL offers capabilities in ion beam analysis not available at MSU. "In particular, the analysis beam energy can be increased to higher values than possible at MSU, to an energy that allows us to analyze thick films and the film-substrate interface," he says. Smith also had high praise for the scientific staff at EMSL. "They were very helpful in refining the experimental procedure specific to the instruments available at EMSL and worked long hours to accommodate our needs," he says.

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