

High Performance Bipolar Plate

Automotive Propulsion System Materials

Transportation

FOR THE 21ST CENTURY

U.S. DEPARTMENT OF ENERGY

ENERGY EFFICIENCY AND
RENEWABLE ENERGY PROGRAM

OAK RIDGE NATIONAL LABORATORY



Background

The next generation of highly efficient and environmentally friendly vehicles will be powered by fuel cell power plants. Companies all over the world are developing this advanced technology today in highly aggressive programs. The technology, though, will only be implemented if the total cost and performance of the fuel cell "engine" is comparable to today's modern internal combustion engine. Progress of this magnitude demands breakthroughs in materials, manufacturing and engineering of key components of a fuel cell system. Porvair Fuel Cell Technology (PFCT), through licensure of material and manufacturing method invented at Oak Ridge National Laboratory (ORNL), is developing and manufacturing one such component: the bipolar plate. Existing bipolar plate materials are either too expensive to manufacture or are too limited in performance to yield a compact fuel cell engine. The technology being scaled up to mass production levels at PFCT has demonstrated the properties critical to achieving the high performance required to drive fuel cells into next-generation automobiles.

The Technology

The technology invented at ORNL manufactures bipolar plates through a multi-step process. First, a preform is made from a mixture of ingredients formed through slurry molding. The detailed bipolar plate flow patterns are then imparted to the preform, before the plate is hermetically sealed through chemical vapor deposition of carbon onto the surface of the plate. The carbon deposit provides exceptional strength and enhanced

conductivity to the bipolar plate material. The high strength of the material enables it to be formed into bipolar plates that are thinner than those made through competitive technologies. The high conductivity of the material increases fuel cell performance.

The Department of Energy is also contributing to the development of this technology through a grant to PFCT. The three-year program allows PFCT to investigate scale-up activities leading to the development of a 300 plate per hour production line. Development activities to date include fine-tuning the product to meet specific customer requirements and to make the product more suited to high-volume manufacturing techniques.

Commercialization

PFCT is actively supplying test plates to major fuel cell manufacturers. Fuel cell testing has confirmed that the product achieves excellent performance in a stack, and aggressive production activities are under way to supply qualification and prototype materials for commercial and transportation applications. Quality assurance activities have been initiated to aid in moving the process from the development lab to the production line. Price estimates have been provided to one customer for interim production quantities in 2003 to support introductory product bipolar plate requirements in the short term. Plans are to accelerate the development of the proposed high-volume production line to mid 2003, to stay ahead of anticipated product demand.

Success Story

Benefits

- High material strength
- High material bulk conductivity
- No corrosion issues with the carbon/graphite composition
- Potential to manufacture very thin plates
- Excellent sealing performance
- Low-cost material ingredients



Prototype material forming equipment



Prototype thermal processing equipment



Carbon/graphite bipolar plate

For more information on how ORNL is helping America remain Competitive in the 21st century, please contact:

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