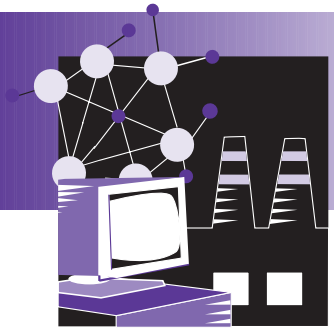


Manufacturing Wear-Resistant Metal-Reinforced Carbon Composites

Benefits

- Significant energy savings should result when the material is included in long-life electrical applications and machine or vehicle components
- Offers unusual wear resistance without lubrication
- Can be machined by generally available methods
- Longer life of material results in fewer replacement costs

Applications

The process is currently being developed for use in the electrical industry. Work is underway to incorporate the material into cable and third rail electric transportation systems. Development of chemical pumps is also underway. In addition, a serendipitous side development may provide long-life wear surfaces for hip replacement prostheses.

A new process creates large, long-wearing pieces of metal-wire reinforced glassy carbon

MRCC, Inc., has created a method for manufacturing a carbon composite material with wear properties equal to or better than existing materials. The material, metal-reinforced carbon composite (MRCC), is chemically inert, operates at high temperatures, and is an effective electrical conductor. MRCC may be made into billets 4 inches or more in diameter and up to several feet long. Electrical contacts, mechanical seals, brakes, pumps, vanes, engine parts, and implanted prosthetics can be cut from these pieces.

The new manufacturing method applies metal fibers of high thermal conductivity to aid in processing and to provide additional strength. Operation in temperatures well above 500°F has been confirmed, along with resistance to acids, bases, and organic solvents in seal configurations. The low friction and long-wear life of the matrix material ensures extended operating life and fewer replacements of components made from the material. It causes correspondingly low wear in companion materials, which include ceramics, metal coatings, and hard and soft alloys of copper and aluminum.

Application of Metal-Reinforced Carbon Composite

With its excellent wear resistance properties and energy savings capacity, the MRCC material is currently being developed for use in cable and third rail electric transportation systems, such as light rail.

Project Description

Goal: The goal of the project is to confirm by field tests and pilot production that the new material can be produced economically in commercial quantities with acceptable quality control.

The new material uses metal-wire reinforcements in the body of a glassy carbon compound. It can be made in pieces of comparable length and greater thickness than current metal-carbon materials. While competitive metal-carbon materials are limited to about $^{3}/_{4}$-inch thickness, the new process yields a glassy carbon material that can be made in 4-inch thickness. These larger billets allow the compound to be used in a wider range of applications.

MRCC, Inc., developed this new technology with the help of a grant funded by the Inventions and Innovation Program through the Department of Energy's Office of Industrial Technologies.

Progress and Milestones

As a result of the work completed under this grant, the following progress has been made:

- Laboratory tests have confirmed that items produced using MRCC attain the expected properties.
- The cup or socket of an artificial hip joint using MRCC is being developed for animal testing.
- MRCC and its technology are protected by U.S. patent 5,182,166. Over 73 articles filed in 1999 supplement the patent protection in the United States and overseas.

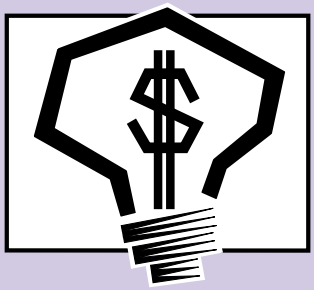
Economics and Commercial Potential

It is too early in the development of new energy conversions to speculate on the long-term potential energy savings that may occur in connection with this invention. However, with the investment currently being made by the electric rail industry into the development and production of this material, it is expected that the potential energy savings with this invention will increase as demand for electric rail transportation increases.

Industry of the Future—Advanced Industrial Materials

The Advanced Industrial Materials Program focuses on the development and commercialization of new or improved materials that enhance productivity, product quality, and energy efficiency in the major process industries. These materials resist high-temperature fatigue, corrosion, and wear. Research focuses on metallic and intermetallic alloys, structural polymers and membrane materials, and materials processing methods.

The OIT Advanced Industrial Materials Leader: Charles A. Sorrell (202) 586-1514



The Inventions and Innovation Program works with inventors of energy-related technologies to establish technical performance and conduct early development. Ideas that have significant energy savings impact and market potential are chosen for financial assistance through a competitive solicitation process. Technical guidance and commercialization support are also extended to successful applicants.

Project Partners

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