High-Temperature Intercalated Graphite Fiber Conductors Fabricated

Composites of intercalated graphite fibers show promise to significantly reduce the weight of electromagnetic interference shielding in spacecraft and aircraft (ref. 1). Bromine-intercalated pitch-based fibers have been among the most heavily studied systems because of their attractive electrical and thermal conductivities and their stability over a wide range of environmental conditions (ref. 2). Previous studies found that the resistivity of bromine-intercalated graphite fibers began to increase when the fibers were exposed to temperatures in excess of about 200 °C in air for long periods of time. If the temperature was as high as 450 °C, the resistivity increased dramatically within a few hours (ref. 2). It remained unclear, however, whether the increase was due to deintercalation of the bromine or to air oxidation of the fibers.

Studies were initially directed toward determining the temperature at which bromine would deintercalate from the fibers, and perhaps become a hazard to both personnel and equipment. So the mass of bromine-intercalated graphite fibers was carefully monitored as it was heated in an inert atmosphere, since the fibers are known to oxidize at a lower temperature than they deintercalate. What was found was that the fibers, which are about 18-wt% bromine, did not lose any appreciable mass even at temperatures approaching 1000 °C. X-ray diffraction studies showed that there were also no changes in the overall structure of the compound. Resistivity measurements indicated that there is some slight degradation in the electronic structure, in that the resistivity increased by a few percent. Overall, the results show that these materials may be suitable for applications at temperatures at least this high, provided oxygen is excluded. This may enable their use in carbon-ceramic, and perhaps even carbon-carbon composites (ref. 3).

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