As part of this effort, researchers are exploring compositions and processing changes that have yielded improvements in properties. Computational materials science and nanotechnology are being explored as approaches to reduce materials development time and improve and tailor properties.

This work was done by Sylvia M. Johnson, Donald T. Ellerby, Sarah E. Beckman, and Edward Irby of Ames Research Center and Matthew J. Gasch and Michael I. Gusman of ELORET. Further information is contained in a TSP (see page 1).

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A process for coating carbon fibers with platinum has been developed. The process may also be adaptable to coating carbon fibers with other noble and refractory metals, including rhenium and iridium. The coated carbon fibers would be used as ingredients of matrix/fiber composite materials that would resist oxidation at high temperatures. The metal coats would contribute to oxidation resistance by keeping atmospheric oxygen away from fibers when cracks form in the matrices.

Other processes that have been used to coat carbon fibers with metals have significant disadvantages:

- Metal-vapor deposition processes yield coats that are nonuniform along both the lengths and the circumferences of the fibers.
- The electrical resistivities of carbon fibers are too high to be compatible with electrolytic processes.
- Metal/organic vapor deposition en-
tails the use of expensive starting materials, it may be necessary to use a furnace, and the starting materials and/or materials generated in the process may be hazardous.

The present process does not have these disadvantages. It yields uniform, nonporous coats and is relatively inexpensive.

The process can be summarized as one of pretreatment followed by electroless deposition. The process consists of the following steps:

1. The surfaces of the fiber are activated by deposition of palladium crystallites from a solution.
2. The surface-activated fibers are immersed in a solution that contains platinum.
3. A reducing agent is used to supply electrons to effect a chemical reduction in situ.

The chemical reduction displaces the platinum from the solution. The displaced platinum becomes deposited on the fibers. Each platinum atom that has been deposited acts as a catalytic site for the deposition of another platinum atom. Hence, the deposition process can also be characterized as autocatalytic. The thickness of the deposited metal can be tailored via the duration of immersion and the chemical activity of the solution.

This work was done by Michael R. Effinger of Marshall Space Flight Center, Peter Duncan and Duncan Coupland of Johnson-Matthey Noble Metals, and Mark J. Rigali of Advanced Ceramics Research. Further information is contained in a TSP (see page 1).

MFS-32021