NASA TECH BRIEF

Refractory-Metal Compound Impregnation of Polytetrafluoroethylene

It has been found that the hexafluorides of rhenium, molybdenum, and tungsten, when placed in contact with bulk polyfluorinated plastics, penetrate the polymer.

It has further been found that the fluorides of rhenium and molybdenum can be hydrolyzed in situ to form metal compounds in the plastic. This, then, is a process for impregnating polytetrafluoroethylene (PTFE) in finished form with rhenium or molybdenum compounds. The resulting product of rhenium impregnation and hydrolysis is a mixture of rhenium oxides (ReO_2 and Re_2O_3). Hydrolysis of molybdenum impregnation produces a material believed to be a mixture of molybdenum oxides. Tungsten hexafluoride impregnated in PTFE reacts somewhat differently. The hydrolysis product grows as fibers of tungstic acid ($H_2WO_4 \cdot H_2O$) on the surface of the plastic.

The resulting impregnated PTFE appears to have very useful properties. One property of the rhenium impregnated PTFE noted is an electrical resistance several orders of magnitude lower than for the unimpregnated material. The specific electrical resistance of the impregnated portion of a one centimeter cube of PTFE, impregnated to a depth of 1.2 millimeters, was found to be 173 ohm centimeters. Comparatively, PTFE has a specific electrical resistance of 10^{18} ohm-centimeters.

The refractory metal impregnated PTFE combines chemical inertness with electrical conductivity. These materials appear to be useful for electro-chemical cells, chemical processing equipment, and protected catalysts. They could also be used in electrostatic charge removal, rf gasketing and electric cable shielding. They may be very useful as bearing materials or where impregnated (filled) PTFE is required as a coating material.

Research is continuing to establish the specific properties of these impregnated plastics and a better understanding of the fundamental process. Additional metal compound impregnants are being investigated.

Notes:

1. Documentation is available from:
   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP-10072
2. Technical questions concerning this invention may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B69-10072

Patent status:

This invention is owned by NASA, and a patent application has been filed. Royalty-free, non-exclusive licenses for its commercial use will be granted by NASA. Inquiries concerning license rights should be made to NASA, Code GP, Washington, D.C. 20546.

Source: H. F. Leibecki
(LEW-10733)

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