



Office of Technology Management

Process of Carbon Coatings (e.g., Graphite, Diamond) on the Surface of Carbides

Technology Reference

CR44 & CU36

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Field

Carbon Coating

Key Words

Carbide
Synthesis
Carbon
Graphite
Diamond structure
Chemical vapor
Deposition
Thin film

License Status

Seeking Licensing Partner

- Exclusive
- Worldwide

Patent Status

U.S. patent 6,579,833.

Overview

A revolutionary method to synthesize carbons on the surface of carbides has been developed. The carbides can be silicon carbide (SiC), titanium carbide (TiC), tungsten carbide (WC) and so on. This approach transforms the surface of carbides into carbons and thus is quite different from the conventional approach where carbon films are deposited on top of carbides. By varying synthetic environment the thickness, porosity, morphology and structure of the carbon coating can be controlled as desired.

Technical Summary

A process for the synthesis of carbon coatings on the surface of metal carbides, preferably SiC, by etching in a halogen-containing gaseous etchant, and optionally hydrogen gas, leading to the formation of a carbon layer on the metal carbide. The reaction is performed in gas mixtures containing about 0% (trace) amounts to 100% halogen-containing gaseous etchant, e.g., Cl₂, and about 0% to 99.9% H₂ (hydrogen gas) at temperatures from about 100.degree. C. to about 4,000.degree. C., preferably about 800.degree. C. to about 1,200.degree. C., over any time range, maintaining a pressure of preferably about one atmosphere, to about 100 atmospheres.

Benefits

- The cost of creating a carbon film by this invention is much less.
- The invention provides a better interfacial strength, since the carbon is not deposited, but is converted from the carbide surface.
- Work to date has shown unexpected resistance to wear.

Areas of Application

- Ion-exchange materials
- Oil pumps
- Steam-powered valves
- Knee replacements
- Electrical conductors
- Bearing applications
- Automotive water pumps
- Steam pumps
- Heart valves
- Torque converters.
- Catalysts and cocatalysts
- Pumps, compressors, and prostheses.

Stage of Development

- Transformation of the surface of carbides into carbon has been made and proved.
- The first application to the seal in a water pump is on the way.
- Work is under way to fully control the carbon structure from a graphite structure to a diamond structure as desired.

