Argonne NATIONAL LABORATORY

Materials Technology

NEW

NFCs REDEFINE WEAR SURFACES

1998 R&D 100 Award Winner

FEATURES AND BENEFITS

- √ Ultra-Low Friction
- √ High Hardness
- √ Wear Resistant
- √ Corrosion Resistant
- √ Excellent Surface Bonding
- √ Excellent Compatibility with Hydrocarbon and Other Fluids
- √ Excellent Deposition Rate
- √ Applicable to Complex Shapes
- √ No Post-Application Machining
- √ Stress-Free Structure

POTENTIAL APPLICATIONS

- √ Sliding and Rotating Surfaces
- √ Metal/Polymer Bearing Surfaces
- √ Gears and Cam-Roller Followers
- √ Air-Conditioning Compressors
- √ Engine Components
- √ Fuel Injectors
- √ Ultra-High Vacuum Devices
- √ Aerospace precision bearings, etc.
- √ MEMS (Micro-Electro-Mechanical Systems)
- √ Biomedical Instruments & Devices

The competitive pressures in today's markets demand continuing improvements in performance, durability and longevity. Improvements in near-frictionless surface coating materials and their deposition processes promise advances in both traditionally lubricated and non-lubricated applications.

Argonne National Laboratory has developed a hard, nearly-frictionless carbon (NFC) surface coating, a unique form of amorphous carbon that has friction coefficients of 0.001-0.006 in a dry, inert environment. By comparison, Teflon's friction coefficient is about 50 times greater, or 0.05.

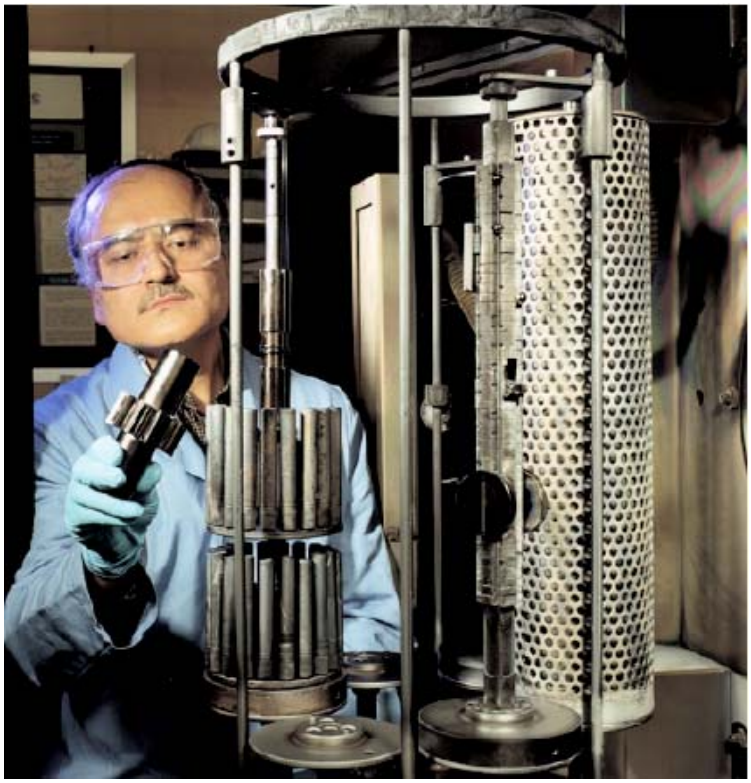

Figure 1. Commercial production scale NFC deposition system at Argonne National Laboratory

Working with an industrial coating company, Argonne researchers are also developing an industrial production-scale deposition system employing new procedures for depositing the Argonne NFC films on metallic and ceramic components. The new system design uses a modified version of existing plasma coating equipment, and is well-suited for the demonstration of production-scale coating for various industrial applications.

Multi-year studies have revealed that NFC films can be applied to a wide range of materials including steel, aluminum and titanium alloys and a variety of glass, ceramics and hard, high-temperature plastics.

STATUS

Argonne is seeking industrial partners to help complete the development of this technology for different applications. The Argonne technology allows the coating composition and process to be optimized to meet the needs of each specific application.

Several different applications are in field test in diverse industries. Argonne researchers are working closely with these industrial partners to optimize the coating and process under field conditions. Testing in several applications has been completed and deployment of one is in progress.

ARGONNE'S NFC TECHNOLOGY IS AVAILABLE FOR LICENSING!

Argonne's unique NFC coatings are patented and are available to industry via license or joint venture. Technical support is available for thorough technology transfer.

CONTACTS

For information on working with Argonne, contact
William D. Ingle, III
(630-252-4694), wingle@anl.gov
Office of Technology Transfer,
Argonne National Laboratory,
9700 South Cass Avenue,
Argonne, Illinois 60439

ABOUT ARGONNE TECHNOLOGY TRANSFER

Argonne National Laboratory is committed to developing and transferring new technologies that meet industry's goals of improving energy efficiency, reducing wastes and pollution, lowering production costs, and improving productivity. Argonne's industrial research program, comprised of leadingedge materials research, cost-saving modeling, and unique testing and analysis facilities, is providing solutions to the challenges that face U.S. manufacturing and processing industries.

The parts coated with Argonne's NFC provide low friction and high wear resistance in mechanical applications involving rolling, sliding, and rotating contacts.

Argonne has tested the performance of these surface coatings over a wide range of configurations, loads, speeds, and temperatures to reduce friction and improve wear and corrosion properties. Argonne researchers are evaluating the effects of humidity on the friction and wear properties, and investigating how to further modify the surface coatings to achieve extremely low friction and wear in both normal air and a controlled environment.

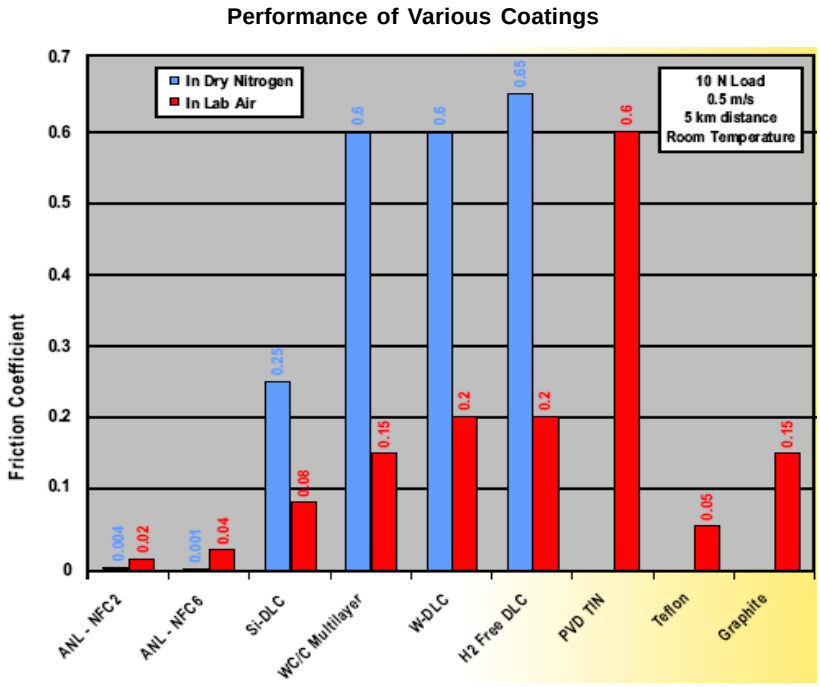

Figure 2. Friction properties of Argonne's NFC coatings and those of other low-friction and commercial diamond-like coating materials.

Figure 2. compares the frictional properties of Argonne's NFC surface coatings with those of other carbon films as well as with alternative low-friction materials and coatings. Thin (1-3 micrometer) NFC surface coatings can be deposited on a broad range of substrates by the Argonne plasma deposition process at relatively low temperatures (room temperature to 200°C) without risking damage to many heat-sensitive materials. The resulting surface coating is highly uniform. Moreover, the deposition process is not simple line-of-sight; it can also be used to coat complex shapes.