

## **i-Kote Advanced Solid Film Lubrication Technology**

*Nanocomposite Coating with Adaptive Chameleon Behavior for Friction and Wear Reduction in Severe and Variable Environments*

### COMPANY BRIEF

Tribologix develops and integrates surface engineering technologies that enhance and enable systems containing moving mechanical components. Moving mechanical components require energy and undergo wear. We develop and transition new technologies to: minimize friction and wear, reduce energy costs, prolong service life, reduce maintenance/repair and improve performance. We strive to better understand materials and to improve their performance through advanced surface engineering initiatives. High performance lubrication technologies are a necessity in today's environment where increasingly difficult requirements are levied, such as making components lighter, stronger, wear better and be more compatible with dynamic operations. Materials can be enhanced in function to meet respective performance properties through the use of tribological coatings via advanced surface engineering.

Technologies that our engineers and scientists have developed are used in gas turbines, cutting/forming tools, precision manufacturing, automotive/racing industries, medical, space mechanisms, munitions and fasteners. Our clients include DOD, DOE, NASA and commercial companies in a broad range of industries. Our expertise is rooted in considerable knowledge as well as success in the development and subsequent commercialization of surface treatments for non conventional environments. Our advanced surface engineering technologies provide new and broader operating windows for moving mechanical parts in extreme environments.

The key to our advancements has been our ability to combine the benefits of two or more materials in to one system. The ability to combine materials on a nano scale and design coating architectures such that material properties that do not co-exist in bulk materials are introduced in to nano-composite structures and perform synergistically has lead to our advanced solid film lubricant technology.

## TECHNOLOGY BRIEF

### Precision Coating Process

1. Non evasive surface preparation
2. Ion assisted bonding technology for extreme adhesion
3. Synergistic components for smart adaptive, chameleon nanotechnology

1. Typical legacy coating failures happen at the interface of the substrate and the coating, thus properly preparing the part for coating is extremely critical. We have developed an environmentally friendly cleaning process that gently, but very effectively, cleans the surface of parts with out blasting or etching, thus eliminating problems with stress risers.

2. Our proprietary ionic bonding insures that the coating is properly anchored to the part resulting in a low temperature deposition, with no binders or adhesives, no curing or baking. Our ionic bonding insures that the coating does not chip, crack or peel. We produce a thin film on the order of 0.000040” which typically does not affect tolerances. i-Kote can be applied to most surfaces including metals, ceramics, carbides and hard coatings.

3. Multi Environmental Performance:

- i-Kote continually adapts and automatically changes its surface characteristics to changing environments in order to provide extreme low friction and low wear
- Much like in nature, the chameleon can change its skin appearance to evade its predators; i-Kote can change its surface to avoid friction and wear
- Designed to self-adjust its tribological contact chemistry and structure depending on the operating environment and temperature. The changes ensure that a correct lubricant occupies the contacting interface and always reduces wear and friction
- Nanocomposite coating structure and chemistry is engineered to provide an optimum blend of hardness, toughness, wear resistance and low friction in environments with variable conditions such as humidity and temperature
- Activation of the “chameleon” behavior is accomplished through the work of friction and lubricant interaction with environment to form lubricious transfer films of the correct composition and chemistry for each operating environment or temperature

Conventional legacy solid film lubricants are designed to perform under specific conditions and thus often perform poorly in variable or demanding environments.

i-Kote provides extremely low friction and low wear in multi environmental applications and can be cycled between environments and maintain extremely low friction and long wear life.

Rigorous experimentation has proven the capability of these coatings in extreme and variable environments including the following:

- Cryogenic
- High Temperature
- Humidity
- Vacuum
- Variable loads and speeds

#### KEY CHARACTERISTICS

Average Coefficient of Friction:	0.01 to 0.1 (condition dependent)
Wear Life:	>10 <sup>6</sup> Cycles
Load Capacity:	350KSI
Temperature:	Cryogenic to 700 deg. C
Environment:	Adaptive, multi, does not collect debris
Adhesion:	Extreme
Storage:	Long term

#### APPLICATIONS

Bearings, gears, splines, bushings, guides, slides, shafts, rings, pins, pistons, camshafts, hinges, seals, rollers; most moving mechanical components.

#### SPACE HERITAGE

Mechanisms used in space are required to operate reliably in extreme and variable environments. Our i-Kote technology has a proven track record for assuring mission success. Example applications include mechanisms for leading organizations such as Orbital, Harris Corp., Sandia, Timken and the International Space Station.