

Ultralow Friction System: Liquid Crystals onto Boron Nitride/Diamond-Like Carbon Multilayered Films Deposited by Plasma Enhanced Chemical Vapor Deposition

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Abstract

The aim of this work is to upgrade the performance of tribological systems by decreasing the friction between the parts. Self-lubricating low friction systems that involve BN and DLC films can be used for high-performance systems. We show the development of an ultralow friction system using plasma technology that can be suitable for application. PECVD was used to deposit thin films of BN and DLC, and Liquid Crystals used as lubricant fluid. Different films were deposited onto steel substrates (AISI E 52100). Tribological tests were performed to measure the resistance of the coatings to wear and the friction coefficient against steel (AISI E 52100). Mechanical, electrical and optical characterisation were performed to characterize the properties of the films. As a result of the work, systems with a friction coefficient as low as $\mu = 0,002$, stable for more than 18 hours under 1,3GPa of pressure (Ball-on-disk) in temperatures above 150°C, and high electrical-resistance were obtained.

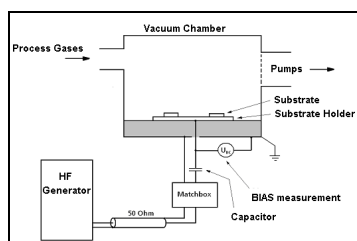


Figure 1: Diagram for PECVD machine

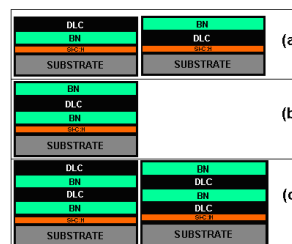


Figure 2: Multilayered systems deposited by PECVD. (a) Dual layered with BN and DLC as function layer. (b) Triple layered with BN as function layer. (c) Four-layers with BN and DLC as function layers.

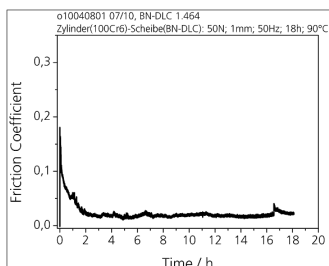


Figure 3: DLC/BN/Liquid Crystal system under tribological testing

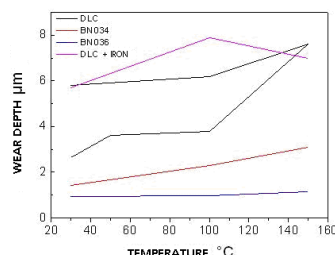


Figure 4: Linear wear of temperature. Ball-on-Disk test, Si_3N_4 sphere, force applied 10N. Comparison between DLC, DLC-Fe and DLC-BN multilayers

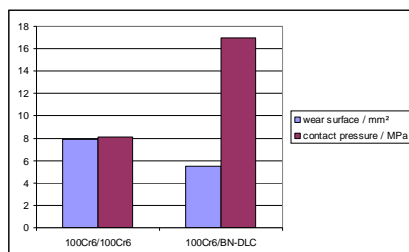


Figure 5: Resulting wear surface and calculated contact pressure after testing

References

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