KN2100

Wear resistant carbon and B-C-N nanostructured films: nanocomposites and multilayers.

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Two different methods of nanostructuration are discussed with regards to the improvement of friction and wear resistance in carbonaceous coatings. In the first case, we consider the incorporation of preformed lubricant nanoparticles into a growing CVD-carbon film to produce nanocomposite coatings. As lubricant filler we use inorganic fullerene-like (IF) WS_2 nanoparticles, with an average diameter of 80 nm, consisting in onion-like structures of closed WS_2 planes. Prior to the film deposition, the particles are dispersed on the substrate surface by dipping in a liquid suspension, and subsequently, the pretreated substrate is exposed to a methane plasma to produce an amorphous carbon film containing well dispersed IF-WS_2 particles.
In the second case, we consider the formation of carbon/h-BN multilayers by sequential evaporation of (i) carbon and (ii) the simultaneous evaporation of boron with a concurrent nitrogen ion beam. In this way, a series of multilayers composed of sublayers ranging from a minimum thickness of 1.5 nm to a maximum thickness of 80 nm are obtained.
Details on film preparation and characterization by SEM and TEM microscopies are discussed for both sets of coatings. Finally, the friction and wear resistance are evaluated by pin-on-disk tests under different atmospheres and test conditions. Both families of nanostructured coatings exhibit very low wear rates, below $1x10^{-7}$ $mm^3/N{\cdot}m$, improving the performance of related non-nanostructured coatings.

Keywords
nanostructured coatings
multilayers
nanocomposites
boron carbon nitrogen
wear