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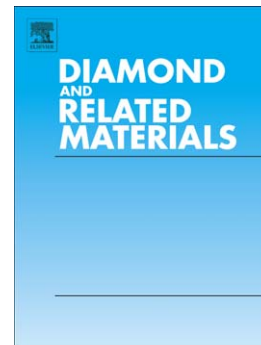
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## Effect of structure of carbon films on their tribological properties

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### Abstract

A comparative study of the tribological properties of a library of different carbon forms is presented. The library includes hydrogen free and hydrogenated carbon films with different bonding (C-C, C-H, different  $sp^3$  fractions) and structure configurations (amorphous, graphitic) leading to a wide range of densities and hardness. Reference samples (Si substrates, thermally evaporated amorphous carbon, graphitic foil) were studied as well. The tribological properties were measured using a reciprocal sliding tribometer under humid (50% RH) and dry (5% RH) air conditions. Friction coefficients were measured versus the number of sliding cycles and the wear was studied using optical profilometry and imaging as well as SEM.

The friction and wear performance of the carbon films was found to depend on both the structure and the ambient conditions. Hydrogen free films have friction coefficients  $<0.1$  for 80%  $sp^3$  bonded films and  $>0.1$  for 100%  $sp^2$  bonded films. The wear resistance of the hydrogen free films (much larger for  $sp^3$  bonded films) significantly decreases under dry conditions. In contrast, hydrogenated films show reduction in friction with decreasing humidity (from 0.2 under 50% RH to  $<0.1$  under 5% RH). The wear resistance of hydrogenated films is larger for dry and smaller for humid conditions.

**Keywords:** tetrahedral amorphous carbon; diamond-like carbon; hydrogenated amorphous carbon; tribology; friction; wear

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