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Tribological behavior of W-alloyed carbon-based coatings in lubricated steel contact.

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The increasing demand for more energy efficiency and environmental friendly products leads to more and more severe conditions to which the surfaces of the components are submitted. Carbon based coatings can be one solution, since they have high hardness, very low friction and wear, and most importantly, they are nowadays available to be applied industrially. However, the knowledge of tribological behavior of C-based coated surfaces in lubricated contacts is still very incipient, mainly when they are alloyed with metals.
C-based coatings with different W content up to 28 at. % (W-DLC:H) were deposited in a 4 cathodes unbalanced magnetron Teer Coatings sputtering apparatus in reactive and non reactive atmospheres (Ar, Ar+CH_4). All deposited coatings have compact morphologies. All W-alloyed deposited coatings presented an amorphous structure; only very broad peaks could be detected for high W contents suggested to be W-carbides nanoparticles. Globally, H-free are harder than W-DLC:H films and the hardness increases from 10 to 15 GPa with increasing W content.
The coatings were pin-on-disk tribologically tested in lubricated contact with three different oils (PAO, paraffin and olive oil) in reciprocating conditions. A coating/steel configuration was used and tested at increasing temperatures. The values of friction for all coatings are in the range from 0.09 up to 0.2 being the limits attributed to a W-free coating tested with olive oil at 70ºC and the 28 at. % W coating tested with PAO oil at 150ºC, respectively. Olive oil gives the lowest friction values for temperatures up to 100ºC. However with the increase of the temperature the friction rises up and goes over the values of the other oils. Paraffin oil gives the highest friction stability with temperature and W addition seems to further stabilize the friction with temperature. In the range of the studied temperatures for lubricated contact, with PAO and paraffin oils, the friction with coated samples are lower than for steel/steel contact.

Keywords
PVD
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