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Cu-doped carbon coatings - driving mechanisms of friction and wear

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Generally, carbon-based coatings have significantly improved the working performance of the surfaces exposed to friction and wear in various environments. It has been showed that the driving effect of carbon-based coatings friction and wear is the third-body sliding interlayer formation. The aim of this work has been focused on interpretation of Cu-C:H tribological behaviour observed at ambient conditions and at elevated temperature. The chemical composition of as-deposited coatings was evaluated by EPMA. The coatings structure was assessed by XRD; the C-C bonding structure was studied by Raman spectroscopy. The hydrogen content was evaluated using RBS/ERDA analysis. The tribological tests were carried out against steel and ceramic spherical counter-parts with a diameter of 8 mm at room temperature in ambient atmosphere, as well as at elevated temperatures up to 400 °C. The tribological performance was examined with respect to the friction coefficient and wear rates of the coating and counter-part. The main attention was paid to the determination of the predominant wear mechanisms, to the characterization of wear debris and to the formation of a tribolayer dominating the tribological process. The worn surfaces were observed by 3D optical profilometry. The changes in chemical composition in both the ball wear scars and the coating wear tracks were evaluated by SEM/EDS. Raman spectroscopy completed the knowledge of the structural changes taking place under ball loading and also of the structure and chemical bonding of the tribolayer. It has been showed that the adhesive wear processes taking place at the coating-ball interface were significantly dependent on testing conditions.

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