Contact size effects on the friction and wear of amorphous carbon films

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Since different properties of coating systems influence their friction and wear at different length scales contact size can play a critical role in microtribological experiments. In this study the behaviour of 3 different types of coating system which vary in terms of their thickness, substrate and mechanical properties has been investigated. The coatings were chosen for either their industrial relevance in automotive or MEMS applications, or as model coating systems.

A wide range of nano/microtribological tests have been performed with different indenter geometries (tip sharpness), including single and repetitive scratch tests with unidirectional contact, and reciprocating wear tests, with depth and friction evolution monitored so that the relationships between failure mechanism and friction in coating systems with differing mechanical properties could be explored.

The influence of surface topography on friction has been shown in ramped and constant load scratch tests. When fracture occurred resulting in a sudden increase in probe depth there was an abrupt decrease in friction which is ascribed to a contact area effect. In contrast, where deformation progressed through micro-wear a more gradual increase in depth can be associated with higher contact area and higher friction.

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