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On the influence from micro topography on the structure and growth of low friction amorphous carbon PVD coatings

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The interest in metal carbide doped amorphous carbon coatings produced by physical vapour deposition (PVD) for use on heavily stressed machine elements is currently increasing, mainly due to their ability to achieve low friction and reduced wear of the counter surface. The tribological properties of these types of coatings have however been found to vary strongly between seemingly similar coatings. A potential source of these differences could be the micro topography of the coated surfaces.
Argon ion etch cleaning of the substrates is a common process step in the production of PVD coatings and is usually performed as the final cleaning step before coating deposition. For some materials, the etching process may result in a roughening of the substrate surface, due to differences in the etch rates of the different parts of the material. In high speed steels, carbides typically etch slower than the metallic phase, resulting in a surface covered by protruding carbides.
In the current study, it was examined how varying amounts of argon ion etching of highly polished high speed steel substrates prior to coating influences the micro topography of the substrates and the final coatings. Tantalum carbide doped amorphous carbon coatings (TaC:C) were produced by co-sputtering of carbon and tantalum, in an argon atmosphere. The impact of the substrate micro topography on the growth and structure of the coatings was studied, using high resolution scanning electron microscopy (SEM) of superficial coating cross sections produced with a focused ion beam (FIB). Special attention was paid to coating growth in the immediate vicinity of protruding carbides, as well as to the structure of the coating in these regions.

Keywords
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