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Influence of PVD coating surface morphology on its tribological properties

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The tribological properties of hard coatings are related to their surface morphology. The incorporation of micro- and macroparticles into a coating and pin-holes created by debonding of such particles changes significantly the surface topography and roughness. All these growth defects also cause higher sticking of the workpiece material, higher friction coefficient and inferior corrosion resistance. In order to improve the tribological properties of PVD hard coatings it is important to minimize the surface concentration of growth defects.
We prepared conventional coatings (TiN, CrN, TiAlN) and nanolayer coatings (AlTiN/TiN, TiAlN/CrN), using three deposition systems: Balzers BAI730 (evaporation with thermoionic arc), CemeCon CC800/7 and CC800/9 (both magnetron sputtering). Several types of substrates were used: powder metallurgical high speed steel (ASP30), cold work tool steel (D2) and cemented carbide.
The surface morphology of the coated substrates was examined by field emission scanning electron microscope (FE-SEM) in combination with focused ion beam (FIB), atomic force microscope (AFM) and 3D stylus profilometer. The statistics of peaks and holes on the coating surface was evaluated at different scales. The following tribological tests were conducted: scratch test, pin on disk, analysis of workpiece material sticking, and corrosion tests (potentiodynamic measurements and electrochemical impedance spectroscopy). Correlations were analyzed between the surface morphology parameters and the results of the tribological tests.

Keywords
PVD coatings
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