OR1004

# Tribological Characterization and Wear Mechanisms of Novel Oxynitride PVD Coatings Designed for Applications at High Temperatures

Jiri Nohava[1], Pascal Dessarzin[2], Pavla Karvankova[2], Marcus Morstein[2]

[1]CSM Instruments, Peseux, Switzerland [2]PLATIT AG, Selzach, Switzerland

jiri.nohava@csm-instruments.com

In recent years, newly developed protective coatings for cutting tools have become highly wear resistant to the extreme environments associated with modern machining processes. On these coatings the common tribological tests have failed, resulting in practically no wear or strongly heterogeneous wear. For efficient tribological testing of the new hard coatings it is therefore crucial to establish a valid set of room- and high-temperature wear test conditions. After a number of preliminary tests performed on a high-temperature pin on disc tester we identified optimized conditions for characterization of this new type of hard coatings.
The investigated coatings comprised nanostructured Al-Cr-based oxynitride coatings deposited using an industrial rotating cathodes arc PVD process on cemented carbide. Nitrogen was progressively substituted by oxygen with up to 100 at.% to avoid oxidation of the coatings at high temperatures. These coatings are known to withstand extremely high temperatures in dry milling of high-strength materials while exhibiting high wear resistance. However, differentiation of their wear resistance by the common tribological tests had proven rather difficult.
The preliminary pin on disc tests were performed at 24°C and at 600°C against alumina balls as the static friction partner, in order to identify the optimum parameters where a measurable wear could be obtained. The key parameters turned out to be the applied normal load and sufficiently long sliding distance. The following tribological tests were performed at 24°C, at 600°C and at 800°C. The wear of the coatings with high oxygen content as measured by surface profilometry was found to be very low. SEM analysis and EDX mapping of the wear tracks revealed that the wear on samples with less oxygen content was governed by abrasive mechanism with limited micro-scale cohesive fracture. All the oxynitride coatings showed very good wear resistance at room temperature, whereas at 600°C and at 800°C the observed differences in the wear rates can be related to the oxygen content.

**Keywords**
oxynitride coating
wear resistant
tribology