Tribological Behaviour of TiAlN and AlCrN coatings deposited over martensitic stainless steel

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Abstract:
Martensitic stainless steels are exposed to different wear mechanisms when used in multiple applications. In order to improve the surface properties, several treatments or coatings can be used. Nitride coatings have high hardness, wear and erosion resistance. The addition of aluminium to binary nitrides increases their corrosion resistance and improves their tribological performance [1,2]. TiAlN and AlCrN coatings are widely used in applications that require high stress resistance, for example, cutting and forming tools and moulds for metal and plastic processing, automotive parts and precision components. Furthermore, these coatings can be used to improve the tribological properties of machine parts in general.
In this work, the tribological behaviour of PVD TiAlN and AlCrN coatings deposited on AISI martensitic stainless steel is studied. The coatings were deposited by cathodic arc PVD in Oerlikon Balzers Argentina.
The microstructure of the coatings was analized by OM, SEM and DRX. The nanohardness was measured by nanoindentation. The pin on disk tests, according to G99 standard, were performed using 5 N and 10 N, 500 m and alumina balls as counterparts. The abrasive wear tests were carried out according to ASTM G65. The adhesion was evaluated using Rockwell C Indentation and Scratch Test.
The thickness reached approximately 3 µm in both coatings. The wear volume loss was twenty five times lower for the AlCrN than the TiAlN in pin on disk tests, under low and high loads, and the steady friction coefficient value was also lower. This indicated that the AlCrN coating has better performance under sliding conditions. However, the mass loss was similar for both coatings under abrasive wear. In the scratch tests, the TiAlN coating failed under less load than the AlCrN, which would indicate lower critical load. Nevertheless, deformation was greater for AlCrN than TiAlN coating as can be observed in Figure 1 and it was measured by a mechanical perfilometer. This could suggest that the fracture toughness was higher for the latter under the same load.

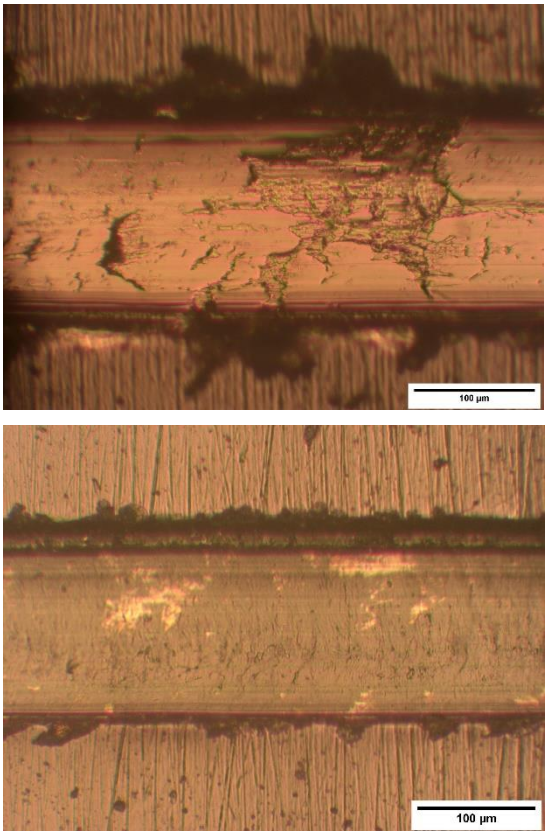

Figure 1: Optical micrographs of scratch tests tracks under 85 N for both coatings.

Keywords: TiAlN, CrAlN coatings, tribological behaviour.

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