

How to design nanostructured PVD nitrides based coatings for increasing the durability of steel ?

P. STEYER, (philippe.steyer@insa-lyon.fr), A. Mege, G. Thollet, C. Esnouf

INSA de Lyon, Laboratoire MATEIS, bât. L. de Vinci, 69621 Villeurbanne cedex, France

The design of thin hard coatings at a nanometer scale seems to be very promising to improve the characteristics of coated parts. Unfortunately, most often only one specific property is really enhanced. Besides, the origin of such a "nanostructure effect" remains still not clearly elucidated, and a wider industrial development requires understanding the relationships linking structure and functionality.

The aim of this talk is to present how it is possible to control the films structure to achieve optimized performance in terms of tribological, mechanical, and physico-chemical behaviours. Both types of films architecture are studied, resulting either from a stratification of nanolayers, or from a nanodistribution of a crystallised phase into an amorphous matrix. To illustrate both structures, arc-evaporated nanomultilayered TiN/CrN and TiSiN nanocomposite coatings are more particularly developed, and compared to a TiN reference.

High wear resistance of TiN/CrN is explained by an original propagation mode of the cracks due to a fluctuating residual stress field, evidenced by TEM and synchrotron measurements [1]. Corrosion behaviour is greatly enhanced by an outstanding covering rate, and depends on the nature of the outer layer. An external CrN layer, affords an enhanced protection. The high oxidation resistance of TiSiN is attributable to the network of refractory SiNx, which acts as a diffusion barrier for oxygen and insulates TiN nanograins from the aggressive atmosphere [2]. An original *in situ* approach of the oxidation phenomena is proposed by means of Environment SEM.

Keywords: Wear, Oxidation, TEM, Nanostratified and nanocomposite films

References:

- [1]: C. Mendibide, P. Steyer, J. Fontaine, P. Goudeau, Surface and Coatings Technology, **201** (2006) 4119.
- [2] P. Steyer, D. Pilloud, J-F. Pierson, J-P. Millet, M. Charnay, B. Stauder, P. Jacquot, Surface and Coatings Technology, **201** (2006) 4158.

Topic: Hard Coatings