PO2041

Investigation of PVD multilayer Cr/DLC coatings for high wear-resistance and low friction applications

Florin Duminica, Raphaelle Belchi, Laure Libralesso

CRM Group, Liège, Belgium

Florin.Duminica@crmgroup.be

Cr/DLC multilayer coatings were synthesized using conventional DC sputtering magnetron technique, without biasing the substrate. A graded composition was used to improve adhesion and to increase progressively the hardness of the coating. The deposition procedures included three steps: firstly, Cr interlayer in the range of 0.5 to 2.5 was sputtered for adhesion promotion; secondly a buffer multilayer system composed of Cr (25) nm and DLC (5 nm) was co-sputtered from Cr and C targets successively, the total bi-compounds multilayer system being about 3 µm thick; finally, top DLC layer in the range of 0.5-1 µm was sputtered from graphite target. Nanohardness of the DLC films was found in the range of 20-22 GPa, while the nanohardness of Cr/C multilayer is 13 GPa. The friction coefficient of the DLC layer is 0.08, and that of the Cr/C multilayers of about 0.2 at a load of 5 N at the end of 125 m of sliding distance. No obvious failure of DLC films was observed by optical micrography in the test range of 125 m. The sliding wear rate of the DLC films is about $3x10^{-15}$ m^2/N , while the wear rate of the Cr/C film is $20x10^{-15}$ m^2/N. The adherence of the coatings was investigated through scratch test and impact HRC test. The sp^3 content of sputtered DLC was determined by Raman spectroscopy in the range of 45 to 50 %. The corrosion properties of these coatings are currently under investigation.

Keywords
PVD
Tribology
Nanoindentation
DLC
Raman spectroscopy