

Cr₂N/CrN multilayer coatings for wood machining tools

B. Warcholinski, A. Gilewicz, J. Ratajski

Koszalin University of Technology, Institute of Mechatronics, Nanotechnology and Vacuum Technique, Raclawicka 15-17, 75-620 Koszalin, Poland

Corresponding author: bogdan.warcholinski@tu.koszalin.pl

Because of anisotropic structure of wood, the coatings for woodworking tools must show excellent impact resistance, good adhesion to the substrate, high hardness and corrosion resistance. The coatings should also enable high performance and good final machined surface quality when high feed and cutting speed are used. The type and architecture of the coating properly matched to type of machining process and processed material can prevent premature or even catastrophic tools' wear.

The paper presents investigation results of structure and properties of the multilayer Cr₂N/CrN coatings deposited using PVD method – cathodic arc evaporation process, on the selected tools for wood machining.

The aim of this tests is developing the deposition technology and modification the architecture of the coatings to improve their mechanical and tribological properties in order to apply of the coatings on the tools for wood machining. The semi-industrial milling test of dry pine wood were performed using a planer knives with multilayer Cr₂N/CrN coatings. This coatings are composed of 7 bilayers of about 340 nm thick. The thickness ratio of Cr₂N and CrN layer in bilayer was (1:1) linking good adhesion of CrN with high hardness of Cr₂N. As the reference uncoated tools were also tested in the same conditions.

Examinations of the chemical composition and structure of the deposited coatings were performed using X-ray dispersive spectrograph and X-ray diffractometer respectively. The investigation includes also analysis of the mechanical and usable properties of the coatings such as hardness tests of the coatings and substrate, surface roughness test, adhesion of the coatings to the substrate, cutting properties of the tested coatings.

The results of investigated Cr₂N/CrN coatings show high hardness – about 22 GPa and critical force – higher than 95 N and low wear rate. The tools with the coating reveal increase of two times their “life time”. So modified tools improve the quality of machined wood surface when compared to uncoated tools.