PO3027

# Wear mechanisms of carbide tools with nanoscale multi-layer composite coatings during machining of various material

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The main reasons of the decrease of performance of coatings are related to intense crack formation (caused mainly by cyclic exposure to thermomechanical stresses) and interdiffusion between tool material and machined material. During the operation of a carbide tool with nanoscale multi-layer composite coatings (NMCCs), are formed transverse and longitudinal (delamination) fatigue cracks. Considers the formation of coatings with nanoscale grain structure and thicknesses of sublayers, which contributes to inhibition of cracks due to their relaxation in milder nanolayers and transformation of most dangerous transverse cracks into longitudinal ones. The application of NMCCs also contributes to significant inhibition of interdiffusion processes expressed in a significant slowdown of mutual diffusion in the "tool-machined material" system. In particular, the study of the chemical composition of the machined material at the tool contact areas showed a significant reduction of diffusing tungsten from carbide substrate by 3-4 times, and the study of the chemical composition of the outer layers of the tool material showed a decrease in the diffusion of iron from the machined material by 2-3 times. The study has revealed a substantial reduction in the intensity of diffusion processes in the application of NMCCs in comparison with coatings of the traditional type (eg TiN or TiAlN, TiCrAl). The application of the developed compositions of NMCCs results in the increase in wear resistance of carbide tools with NMCCs during machining of structural steels by up to 4-5 times as compared with uncoated carbide tools and by up to 2-2.5 times as compared with tools with the coatings of traditional types

**Keywords**
wear
multi-layer composite coatings
carbide
nanoscale
crack