

Nanostructured Coatings via Environment Friendly Deposition Technique for
Demanding Tribological Applications

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Abstract

Present trends in metal cutting, high speed/feed machining, hard and dry cutting set more demanding characteristics for cutting tool materials. Machining leads to high friction between tool and work piece, and can result in high temperatures, impairing the dimensional accuracy and the surface quality of products. Applications of conventional cutting fluids are a major source of pollution. Solid lubricant assisted machining is an environmental friendly clean technology for desirable control of cutting temperature.

The present work investigates the role of nano coated (water based sol-gel ceramics) tools of different tool geometry (milling tool: radial rake angle and nose radius) in machining on surface quality, wear rate, cutting forces and specific energy. Multilayer coatings (i.e. Al₂O₃, TiO₂, SiO₂ etc.,) were applied by using dip coating method on CNC tools with help of water based sol-gel ceramic solution. These coatings act as solid lubricants. The performance of solid lubricant assisted machining was studied in comparison with uncoated tool. These coatings are characterized by High Resolution Scanning Electron Microscope (HRSEM), Scratch test analysis and nanoindentation.

Keyword : Cutting tools, Solid lubricant, Water based sol-gel method, Tool geometry, Dry machining