

PO2020

Cutting tools with nano structured sputtered hard coatings

Martin Keunecke¹, Christian Stein¹, Klaus Bewilogua¹, Werner Koelker²,
Stephan Bolz², Dieter Kassel³, Henk van den Berg³

¹Fraunhofer IST, Braunschweig, Germany ²CemeCon AG, Wuerselen,
Germany ³Kennametal Shared Services GmbH, Essen, Germany

martin.keunecke@ist.fraunhofer.de

Hard coatings like TiN or TiAlN are well established in industrial use as tool coatings. These coatings often are prepared by PVD techniques like arc evaporation or d.c. magnetron sputtering. Typical micro hardness values of such hard coatings are in the range of 30 GPa. As a clear advancement compared to d.c. magnetron sputtering processes the pulsed magnetron sputter deposition technique could be shown. TiAlN hard coatings as well as TiAlN coatings modified by incorporation of elements like Cr and Si were prepared using the pulsed magnetron sputter technique in a CC800/9 batch coater. The coatings provide high hardness, high wear resistance and by alloying Cr and Si a clear improvement of the oxidation resistance at high temperatures. Additionally the HIPIMS-Technology was applied to gain further benefits. Higher ionization of the metallic plasma species and enhancement of the plasma energy density result in denser coatings at high hardness and low internal stresses levels. Beside hardness and wear other properties like adhesion or coating morphology were investigated. The chemical composition of the coatings was determined by EPMA and the crystal structure was derived from X-ray diffraction analyses. Using pulsed magnetron sputter processes the coating properties, especially the hardness could be significantly improved. With HUplast > 40 GPa the range of superhard materials could be reached. Additionally, such coatings were successfully applied as interlayer for cubic boron nitride tool coating systems. The application potential of these modified nitride hard cutting tool coatings will be demonstrated by turning and milling tests results. The cemented carbide cutting tools used in the tests were recently developed from novel nano grained cemented carbide powders. Especially for difficulty to cut Ni and Co based super alloys as well as for Titanium these tools show a clear superiority compared to common tool solutions.

Keywords

cutting tool coating

sputter deposition

Nitrides

TiAlN

HIPIMS