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Arc Evaporated Ti-Al-N / Cr-Al-N Multilayer Coating Systems for Cutting Applications

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Abstract

Ti-Al-N based coatings are presently state-of-the art for severe cutting applications. Further improvement of these coatings can be reached by multilayer architectures in combination with different layer materials. Within this work, multilayer arrangements consisting of Ti-Al-N and Cr-Al-N sublayers with different chemical composition and sublayer thicknesses were investigated. All coatings were deposited via cathodic arc evaporation. The individual sublayers of the multilayer coatings exhibited thicknesses of 10, 30, 100 and 300 nm, respectively. The morphology and microstructure of the coatings were investigated by scanning and transmission electron microscopy and X-ray diffraction. Mechanical properties were evaluated using nanoindentation and milling tests. In addition, the thermal stability of the coatings was characterized by annealing experiments. An optimum in hardness and cutting performance was obtained for multilayers with 10 nm sublayer thickness and high Al contents within the Ti-Al-N layers, whereas the Al content in the Cr-Al-N sublayers showed only a minor effect.

Keywords

PVD, Ti-Al-N, Cr-Al-N, Multilayer, Microstructure, Hardness, Thermal stability, Milling

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