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Investigation of the thermal stability of metastable Ti1-xAlxN hard coatings

Birgit Grossmann[1], Nina Schalk[1], Christoph Czettl[2], Markus Pohler[2], Christian Mitterer[1]

[1]Montanuniversität Leoben, Leoben, Austria [2]Ceratizit Austria GmbH, Reutte, Austria

birgit.grossmann@unileoben.ac.at

The thermal stability is one of the most important properties of hard coatings required for high-performance cutting tools. Decomposition as well as phase transformation can be initiated in metastable hard coatings by the elevated temperatures arising during machining. Within this work, the microstructural evolution of $Ti_{1-x}Al_xN$ hard coatings with $0.4 \leq x \leq 0.67$ grown at two different bias voltages was investigated by differential scanning calorimetry. Complementary, vacuum annealing treatments up to 1500°C with subsequent X-ray diffraction analysis provided comprehensive insight into the microstructural changes of the coatings. In the as deposited state, the coatings with $x<0.6$ show a single phase cubic structure, and at the higher bias voltage, the formation of the wurtzite AlN phase is shifted to higher Al contents. At elevated temperatures, the lower bias voltage retards the formation of wurtzite phase as well as the onset of spinodal decomposition.

Keywords
TiAlN
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hard coating