Lodz University of Technology
Materials Engineering

PhD thesis abstract

Title: „Modified (Ti,Al)N-based wear resistant coatings – deposition and properties"

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(Ti,Al)N based thin films already traditionally belong to the group of wear resistant coatings which among others, single- or multi-component transition metal nitrides, are used when an improvement of performance and life time of cutting tools is expected.

Due to Al content in (Ti,Al)N coatings their oxidation resistance is higher than that of traditional TiN layer. It is a reason why they are widely used as a protective layer deposited at tools for high speed machining.

The presence of Al in (Ti,Al)N coatings overcomes the oxidation problems due to the presence of a superficial layer of Al_2O_3 formed at high temperature. Simultaneously, due to high friction it contributes to undesirable increase of tool temperature and promotes wear processes.

Reduction of friction forces is possible by an appropriate modification of chemical composition of these coatings. The tribological properties of the (Ti,Al)N - based wear resistance coating can be advantageously modified by introducing dopant metals like Mo or V. Oxides of these metals are characterized by self-lubricating properties.

Furthermore, doping of coatings with oxide-forming metals like Mo or V can promote an increase the corrosion resistance of the coating by facilitating processes of passivation.

(Ti,Al)N based coatings have been deposited by reactive vacuum arc evaporation combined with co-deposition of molybdenum or vanadium from planar magnetron source.

In the course of this study Mo or V doped (Ti,Al)N coatings have been deposited at high speed steel (HS6-5-2) substrates. Their structure, phase composition, adhesion, hardness, friction and wear as well as corrosion resistance have been studied.

Mo or V doped (Ti,Al)N coatings have shown improved tribological properties manifesting itself in low friction and wear rate. Simultaneously, very good mechanical properties and adhesion of (Ti,Al)N based coatings had been preserved.

An improved corrosion resistance of Mo doped (Ti,Al)N coatings had also been observed.

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