Microstructure Evolution in Sintering of Functional Gradient Hardmetals upon Various Gas-phase Treatment Conditions

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Abstract

The application of an appropriate gas-phase with respect to composition, pressure and time of supply within the sintering cycles plays a crucial role for the bulk and especially near-surface properties of functional gradient hardmetals. Recent achievements in this field are briefly summarised. The goal of the study was to optimise these properties such as wear and plastic deformation by a detailed investigation of the evolution of the microstructure by application of interrupted sintering cycles, XRD as a function of depth, and magnetic measurements. This gave insight into the densification, the presence of phases, the occurring diffusion process and the interaction of hard grain components with the gas phase.

The Effect of the Substrate Surface Characteristics on AIP PVD Coating of Cemented Carbide Inserts and their Cutting Performance

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Abstract

Arc Ion Plating PVD coating has a good adhesion with substrates and also has good thermo-mechanical properties that can be widely applied to hard materials such as cutting tools dies and molds. Ultra fine cemented carbide substrates of good cutting edge strength show the excellent cutting performance from the nitrogen coating like TiCN and AlTiN. Coating layer property of PVD coating, which deposited relatively lower temperature than CVD, can largely be changed by chemical compositions and micro morphologies. In this study, coating properties of AIP PVD nitride coating layer on cemented carbide substrate compositions, WC size variations and coating layer surface characteristics such as roughness and morphology were studied. The effects of the wear and breakage behavior in the cutting performance were investigated for the surface property of ultra fine cemented carbide substrates. Surface properties and morphologies of cemented carbide substrates largely affect the deposition property and thermo-mechanical property of coating layer. Moreover property improvement on the substrate surface could improve the coating layer adhesion and roughness. As a result in cutting performance, breakage resistance behavior of the AlTiN coating layer with high Al composition also improved.