PO4019

W-B-C hard yet ductile coatings prepared by High Power Impulse Magnetron Sputtering

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As the demands for the quality and speed of machining increase, the application of protective coatings on the used cutting tools becomes ever more important. Nowadays used ceramic protective coatings exhibit high hardness and toughness, however, they suffer from inherent brittleness. This can lead to a premature failure of the coating and of the cutting tool as a whole due to rapid crack propagation. Therefore, a new generation of coatings combining hardness and moderate ductility is sought for. Such a coating was recently in the form of an inherently nanolaminated X_2 BC, where X is a metallic element. Mid-frequency pulsed DC magnetron sputtering was used in our previous study as a means to enhance the ion bombardment of the growing coating for preparation of W-B-C coatings whilst avoiding the complexity and the cost of HiPIMS. The W-B-C system was chosen as the calculated mechanical properties of W_2BC even surpassed those of the only experimentally reported in the literature - Mo_2BC. The deposition temperature of ~ 500 °C was used. The W-B-C coatings had a nearly amorphous or a nanocomposite structure with sparse grains with the size of < 5 nm. Columnar growth was typical for all coatings. The resulting hardness was in the range of 22 – 26 GPa. This contribution summarizes the properties of the W-B-C coatings when HiPIMS was used for the deposition. The changes in the microstructure as compared to the pulsed DC case are described. These are also correlated with differences in the mechanical properties.

Keywords
Magnetron sputtering
Hard coatings
Nanostructure
HiPIMS