Characterizations and drill performance of AlCrCN coatings deposited by high power impulse magnetron sputtering

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In recent years, the production capacity of printed circuit boards (PCBs) has increased significantly resulting in an increase in the demand for micro drills, especially in the requirements of wear-resistant properties. Therefore, various PVD technologies are applied, especially the high power pulsed magnetron sputtering (HiPIMS) technology has the most potential for application, which due to the high ionization rate leads to high density and high mechanical properties of the thin film.

In this study, AlCrCN coatings were prepared via HiPIMS with four $Al_{70}Cr_{30}$ targets and two Cr targets, with a focus on the effects of carbon content and substrate bias on the microstructure, mechanical properties, and drill performance of the coatings. FE-SEM revealed the interlayers designed to improve adhesion strength from 10 N up to 58N. The highest hardness (3045 Hv) and highest adhesion force (58 N) were obtained by increasing the bias voltage (−75 V) with a carbon content of 9.4 at%. The drill test results showed better wear resistance and useful lifetime than CrAlN coating for PCBs application.