

Comparative analysis of the influence of pre-treatment of WC-9%Co substrate on the adhesion of CVD diamond films

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CVD diamond coatings can prolong significantly the lifetime of WC-Co hard metal tools. However, the cobalt, which is used as a binder phase of the hard-metal substrate, influences the diamond film deposition and reduces its adhesion to the substrate surface. In order to improve the quality and adherence of the diamond film, pre-treatment procedures of WC-Co substrates have been investigated using different chemical solutions to remove the cobalt from the substrate surface. In this work, we compare three chemical pre-treatments of WC-9%Co substrates using the following solutions: (i) $\text{H}_2\text{SO}_4 + \text{H}_2\text{O}_2$, (ii) $\text{HCl} + \text{HNO}_3$ and (iii) $\text{HCl} + \text{HNO}_3 + \text{H}_2\text{O}$. Before, all substrates were etched in Murakami solution. The elemental composition of the substrate surfaces, before and after chemical treatments, was investigated by SEM and EDS. Subsequently, the treated substrates were coated with diamond films deposited by hot-filament CVD. Finally, the samples were characterized by XPS, Raman spectroscopy, SEM and adhesion measurements.