SiC interlayer by laser-cladding on WC-Co substrates for CVD diamond deposition

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Despite their huge industrial potential and commercial interest, the direct diamond coating on cemented carbide (WC-Co) is limited, mainly because of the catalytic effect of Cobalt (Co) and the high difference in thermal expansion coefficient [1]. This results in poor adherence between diamond and WC-Co. In addition, the low diamond film adhesion to the cemented carbide useless for machining applications. Removal of Co binder from the substrate surface by superficial etching is one of the techniques used to improve the adhesion between diamond and WC-Co. For the present study, diamond films were deposited on WC-Co substrates with an intermediate barrier to block the Co diffusion to the surface substrate. The laser cladding process produced the SiC barrier, in which a powder layer is melted by a laser irradiation to create the coating on the substrate. The use of laser cladding is the novel method for an intermediate barrier for cemented carbides. The advantages of laser cladding include a faster processing speed, precision, versatility. We reported the application of pretreatment method called ESND (Electrostatic self-assembly seeding of nanocrystalline diamond). The nucleation density was around 10^{11}part/cm^2. Diamond films were grown by Hot Filament Chemical Vapor Deposition. Characterization of samples included Field Emission Gun-Scanning Electron Microscopy (FEG-SEM), Energy Dispersive X-ray (EDX), X-ray diffraction (XRD) and Raman Scattering Spectroscopy. Results showed that laser irradiation formed stable Co compounds in the interfacial barrier. It is because nucleation and good quality of diamond film since the cobalt are no longer free to migrate to the surface during the CVD diamond deposition.

Reference:

[1] Y. X. Cui, B. Shen, F. H. Sun. Diamond deposition on WC–Co substrate with amorphous SiC interlayer, Surface Engineering, 30, (2014) 237-243.