CVD diamond deposition on hardmetal (WC-Co) using a boron carbide interlayer

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Extensive research has been throughout made to turn diamond thin film on hardmetal technologically viable for machining aerospace alloys. Diamond coating on cemented carbide suffer from some problems. The poor adhesion between diamond film and WC-Co is the main problem. In the WC-Co inserts, poor adhesion can result in delamination during machining. Another problem is diamond graphitization due to the cobalt (Co) interdifussion during the CVD deposition [1]. In order to reduce the catalyst effect of Co it is necessary superficial etching. In this work, we have investigated the influence of boron carbide interlayer sintered by laser-cladding on WC-Co substrate for CVD diamond deposition. The boron carbide powder layer was sprayed by the air gun, the interlayer were subsequently irradiated (sintered) by laser. The boron carbide interlayer made by laser cladding, blocked the negative effects of the cobalt binder in the process of coating WC-Co with CVD diamond films. To increase the diamond nucleation, we report the application of pretreatment method called ESND (Electrostatic self-assembly seeding of nanocrystalline diamond) [2]. The nucleation density with this method is around 10^{11}part/cm^2. Continuous and adherent diamond films were obtained on WC-Co substrates with high diamond particles density using HFCVD reactor. The residual stress was investigated by micro-Raman spectroscopy. X-ray Diffraction (XRD) was used for quantitative analysis of phases laser cladding process. Inserts were characterized by Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray (EDX) for qualitative analysis.