The effect of $Na_2B_4O_7.10H_2O$ (Borax) in the formation of vanadium carbide (VC) layer on tool steels.

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The thermoreactive deposition process (TRD) is a method of coating steels with a hard and wear resistant layer of carbides [1]. In salt bath elements such as vanadium, niobium, tantalum and others can be deposited on the steel surface [2]. The vanadium form nonporous carbides with high hardness (3200-3800) HV, mechanical, chemical and wear resistance, chemical compatibility with diamond and steel, growth layers with 0.3 to 10 µm and has thermal expansion coefficient around $6{,}06x10^{-6}$ K^{-1} [3]. These characteristics are attractive to use vanadium carbide as interlayer in the diamond growth by Hot Fillament Chemical Vapor Deposition (HFCVD). It is important that the transition zone has sufficient thickness and uniformity to alleviate the stress after cooling. The substrate carbon diffused at surface and reacts forming a dense and metallurgically VC bonded. The salt bath was compound for borax ($Na_2B_4O_7.10H_2O$), vanadium pentoxide (V_2O_5) and boron carbide (B_4C) mixt in a melting pot, which is heated at 1050°C. The borax reduce the melting point, protect the steel from atmospheric oxygen attack and provide elements freedom in the melting liquid making possible the vanadium carbide (VC) reaction to occur. As a substrate was selected AISI D2. The boron proportion was varied in the range of 62% to 72% in the powders weigh. The VC-TRD coatings morphology, structure, resistance and thickness were characterized by scanning electron microscope with field emission (SEM-FEG), X-ray diffraction and scratching. The HFCVD diamond was characterized by SEM-FEG and Raman spectroscopy. A good result was obtained with 68% of borax with 10µm thickness and 36N of load in scratching test. The film had not been formed in some regions below this proportion. Above 68% boron competes with vanadium in the coating formation. The HFCVD diamond showed high purity and crystallinity. The thermal residual stress reduced

demonstrate the excellent performance of vanadium carbide as an intermediate layer.