307-047

SYNTHESIS OF VANADIUM INTERFACE FOR HFCVD DIAMOND DEPOSITION ON STEEL SURFACE

Damm, D.D.(1); Contin, A.(2); Campos, R.A.(3); Andrade, A.E.N.(4); Almeida, K.F.(5); Barquete, D.M.(5); Corat, E.J.(2); Trava-airoldi, V.J.(2);
Universidade Federal de São Paulo(1); Instituto Nacional de Pesquisas Espaciais(2); Universidade Federal do Sul e Sudeste do Pará(3); Escola Técnica Everaldo Passos(4); Universidade Estadual de Santa Cruz(5); Universidade Estadual de Santa Cruz(6); Instituto Nacional de Pesquisa Espacial(7); Instituto Nacional de Pesquisas Espaciais(8);

Vanadium coverage has been used in the industry to improve the steel properties some time ago. The vanadium interface deposition for CVD diamond grow on steel has been done for researchers although thermodiffusion, sputtering and others techniques. This work we will discuss the vanadium deposition by laser cladding on steel surface as intermediary layer for HFCVD diamond deposition. Vanadium has particular characteristics as high hardness, carbides forming ability, chemical compatibility with carbon steel and CVD diamond and coefficient of thermal expansion intermediate between these materials. The main problems to grow CVD diamond directly on steel surface is related de adhesion, crystallinity and purity. The distance between theses coefficients of thermal expansion result in a residual compressive tension in the diamond film causing delamination during cooling. The transitions metals (iron and cobalt as exemplum) present in the steel surface inhibit the sp3 bond over the sp2 bond providing the appearance of graphite on CVD film that reduces the film quality. An intermediate layer is necessary to create a transition zone able to relive the residual thermal stress and also acting as a barrier to metal transitions migration to diamond deposition region. The laser cladding was selected because its rapid processing, excellent metals adhesion by melting, good surface finish reducing roughness and capacity to preserve the original properties of the material substrate interacting only with the up layers of the material. The laser cladding was processed in two stages. In the first step the powder was dispersed on the entire surface of the substrate and a second step the laser was beam focused on the interface. A weld puddle is formed on the substrate surface due to absorption of the beam energy. The energy conduction promotes the expansion of this puddle and the substrate acts as an efficient heat dissipater causing rapid solidification of the coating. The sintering parameters as resolution (PFP), scanning speed (mm/s) and number of heating cycles (NHC) were varied systematically to obtain better adhesion and greater thickness of the vanadium film. The diamond films were deposited in a HFCVD reactor for a period of 3h. The results were obtained by X-ray diffraction, scanning electron microscope, scratching test and Raman spectroscopy.