Thermal Oxidation Promotes Growth of Nanocrystalline Diamond on Biomedical Grade Co-Cr-Mo Alloy

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Abstract:
Diamond coatings are employed to yield significant benefits in applications such as for cutting tools, optical lenses, biomedical components, microelectronics, engineering and thermal management systems. Although there are many research reporting the successful of diamond coating on titanium, tungsten carbide and steel alloys but there are still lacking of research on the cobalt based alloy as the substrate. In order to coat diamond on these metals substrate, chemical vapor deposition (CVD) technique is commonly used. This paper reports on investigations of nano-crystalline diamond (NCD) coating on different carbon content of cobalt based alloys. Emphasis is given to achieve good adhesion of NCD coating on high and low carbon content of cobalt-chromium-molybdenum (Co-Cr-Mo) alloys using two different processes of surface pretreatment such as mechanical roughening the sample surface (≈0.3µm) and by using thermal oxidation to create oxide interlayer. The results revealed that most of the coating on samples was peel-off on roughened surface. However, there were small portion of NCD coating that still intact on sample with oxide interlayer. The thickness NCD coating obtained was approximately 5µm. Since the adhesion strength of the diamond coatings were very poor and easily delaminated, scratch test could not be performed on both sample conditions. Surface morphology and characterization of diamond coatings were investigated by Scanning Electron Microscopy (SEM) and X-ray diffraction respectively.

Keywords: Co-Cr-Mo Alloy; Thin Film; NCD Coating; Surface Morphology; Biomaterial

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