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Suspension Plasma Spray Coatings for Biomedical Applications

Abstract:

Axial suspension plasma spraying (ASPS) is a relatively new but effective method to produce multifunctional advanced coatings. This work highlights the influence of incorporated graphene nanoparticles (GNPs) and Silver (Ag) nanoparticles on the behavior of ASPS hydroxyapatite (HAp) based composite bio-coatings. Hap-GNP-Ag coatings with varying GNP contents (0, 0.5, 2 and 5 wt. %) and Ag (1, 3 and 5 wt.%) were produced and investigated. Characterization of the ASPS Hap-GNP-Ag coatings was carried out using SEM, EDS, Confocal Raman, White light interferometry, and contact angle measurements. Mechanical properties such as hardness, roughness, adhesion strength and porosity were also evaluated along with fretting wear performance. Additionally, the biocompatibility of Hap-GNP-Ag coatings was evaluated via cytotoxicity testing and visualization of cell adhesion using SEM and Laser Scanning Microscopy. The addition of GNP enhanced the tribo-corrosion resistance properties whereas the addition of Ag nanoparticles enhanced the antibacterial properties of the coatings. In gene expression studies, a 2% GNP content upregulated RunX2 gene and down-regulated pluripotent gene NANOG and SOX2, implying this composition to be a much-suited candidate among the rest for bioactive orthopedic coatings.

Biography:

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