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PII: S0257-8972(16)30783-6
DOI: doi: 10.1016/j.surfcoat.2016.08.039
Reference: SCT 21479

To appear in: *Surface & Coatings Technology*

Received date: 21 April 2016
Revised date: 5 August 2016
Accepted date: 15 August 2016

Please cite this article as: Gobi Saravanan Kaliaraj, M. Bavanilathamuthiah, Kamalan Kirubaharan, D. Ramachandran, T. Dharini, K. Viswanathan, Vinita Vishwakarma, Bio-inspired YSZ coated titanium by EB-PVD for biomedical applications, *Surface & Coatings Technology* (2016), doi: 10.1016/j.surfcoat.2016.08.039

Bio-Inspired YSZ Coated Titanium by EB-PVD for Biomedical Applications

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Abstract

Yttria stabilized zirconia (YSZ) coating was deposited onto titanium (Ti) substrate using electron beam physical vapor deposition (EB-PVD) method. The crystalline nature of as-deposited YSZ coating was evaluated using X-ray diffraction (XRD) technique and cubic phase was noticed. Smooth and uniform surface topography was observed by atomic force microscopy (AFM) analysis. The hardness and scratch resistance of the coating was determined by nanoindentation and scratch test analysis respectively. Wettability studies exhibited more hydrophilic nature on YSZ coating and least hydrophilic on uncoated Ti substrate. Anti-adhesion and antibacterial efficiency were performed against gram (+)ve (*S.aureus*) and gram (-)ve (*E.coli*) bacterial strains and revealed that YSZ coating effectively protected bacterial invasion. Hemocompatibility was evaluated by platelets adhesion and their activation behavior was studied onto uncoated and YSZ coated Ti substrates (test samples) and YSZ coating exhibited less activated platelets; whereas, platelet activation (large number of pseudopods) were seen on uncoated Ti substrate. Furthermore, superior in vitro biomineralization behavior with increased weight gain, higher protein adsorption and superior biocompatible nature with NIH 3T3 fibroblast cells were observed on YSZ coating than that of uncoated Ti substrate. Overall results indicated that surface modification by YSZ coating could become a promising material for biomedical applications.