Aerosol Deposition and Its Potential Use for Bioactive Ceramic Coatings

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Aerosol Deposition (AD) is a novel way to fabricate bioactive ceramic coatings in biomedical implants and prostheses applications. In the present work, silicon-substituted hydroxyapatite (HA) coatings on commercially pure titanium were prepared by aerosol deposition using Si-HA powders. The incorporation of silicon in the HA lattice is known to improve the bioactivity of the HA, making silicon-substitute HA an attractive alternative to pure HA in biomedical applications. Si-HA powders with the chemical formula Ca_{10}(PO_{4})_{6-x}(SiO_{4})_{x}(OH)_{2-x} having silicon contents up to x=0.5 (1.4 wt.%), were synthesized by solid-state reaction of CaP_{2}O_{7}, CaCO_{3}, and SiO_{2}. The Si-HA powders were characterized by X-ray diffraction (XRD), X-ray fluorescence spectrometry (XRF), and Fourier transform infrared spectroscopy (FT-IR). The corresponding coatings were also analyzed by XRD, scanning electron microscopy (SEM), and electron probe microanalyzer (EPMA). The results revealed that a single-phase Si-HA was obtained without any secondary phases such as α- or β-tricalcium phosphate (TCP) for both the powders and the coatings. The Si-HA coating was about 5 µm thick, had a dense microstructure with no cracks or pores. In addition, the proliferation and alkaline phosphatase (ALP) activity of MC3T3-E1 preosteoblast cells grown on the Si-HA coatings were significantly higher than those on the bare Ti and pure HA coating. These results revealed the stimulatory effects induced by silicon substitution on the cellular response to the HA coating.

Keywords: Aerosol Deposition, Hydroxyapatite, Silicon, Coating

Cell Growing Behavior on the Electrospun PVA/GE nanofibermats.

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Electrospinning of Polyvinylalcohol (PVA), Gelatin (GE), and PVA/GE blend solutions in acetic acid were investigated to fabricate biodegradable for tissue engineering. The morphology of the electrospun nanofibers was investigated with a field emission scanning electron microscope. The fibers have average diameters in the range 50-150 nm. The miscibility of PVA/GE blend fibers was examined by differential scanning calorimetry. The PVA and GE were immiscible in the as-spun nanofibrous structure. X-ray diffraction (XRD) determined the crystallinity of the membrane and tensile strength for evaluation physical properties. An in vitro study of PVA/GE blend nanofibers was conducted. To assay the cytocompatibility and cell behavior on the PVA/GE blend nanofibrous scaffolds, cell attachment and spreading of fibroblasts seeded on the scaffolds were studied. Our results indicate that the PVA/GE blend nanofibrous matrix, particularly the one that contained 20% PVA and 80% GE could be a good candidate for tissue engineering scaffolds, because it has excellent cell attachment and spreading for fibroblast cell.

Keywords: PVA, GE, Electrospinning, PVA/GE blend, Fibroblast cell