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Aerosol Deposition and Its Potential Use for BioactiveCeramic Coatings

Byung-Dong Hahn[†], Dong-Soo Park, Jeong-Min Lee, Jong-Jin Choi, JunghoRyu, Woon-Ha Yoon, Byoung-Kuk Lee, Joon-Hwan Choi[*], Hyoun-Ee Kim[*]

Functional Ceramics Research Group, Korea Institute ofMaterials Science;
[*]School of Materials Scienceand Engineering, Seoul National University
(cera72@kims.re.kr[†])

Aerosol Deposition (AD) is anovel way to fabricate bioactive ceramic coatings in biomedical implants andprostheses applications. In the present work, silicon-substitutedhydroxyapatite (HA) coatings on commercially pure titanium were prepared byaerosol deposition using Si-HA powders. The incorporation of silicon in the HAlattice is known to improve the bioactivity of the HA, makingsilicon-substitute HA an attractive alternative to pure HA in biomedicalapplications. 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 bysolid-state reaction of $Ca_2P_2O_7$, $CaCO_3$, and SiO_2. The Si-HA powders were characterized by X-ray diffraction (XRD), X-rayfluorescence spectrometry (XRF), and Fourier transform infrared spectroscopy(FT-IR). The corresponding coatings were also analyzed by XRD, scanningelectron microscopy (SEM), and electron probe microanalyzer (EPMA). The resultsrevealed that a single-phase Si-HA was obtained without any secondary phasessuch 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 densemicrostructure with no cracks or pores. In addition, the proliferation andalkaline phosphatase (ALP) activity of MC3T3-E1 preosteoblast cells grown onthe Si-HA coatings were significantly higher than those on the bare Ti and pureHA coating. These results revealed the stimulatory effects induced by siliconsubstitution on the cellular response to the HA coating.

Keywords: Aerosol Deposition, Hydroxyapatite, Silicon, Coating

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Cell Growing Behavior on the Electrospun PVA/GE nanofibermats.

Nguyen Thuy Ba Linh, Thi-Hiep Nguyen, Ho-Yeon Song[*], Hun Mo Yang[**], Young Ki Min[**], Byong-Taek Lee[†]

Department of Biomedical Engineering and Materials, School of Medicine, Soonchunhyang University;
[*]Departmentof Microbiology, School of Medicine, SoonchunhyangUniversity;
[**]Department of Physiology, Schoolof Medicine, Soonchunhyang University
(lbt@sch.ac.kr[†])

Electrospinning of Polyvinylalcohol (PVA), Gelatin (GE), and PVA/GE blend solutions in acetic acid wereinvestigated to fabricate biodegradable for tissue engineering. The morphologyof the electrospun nanofibers was investigated with a field emission scanningelectron 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-raydiffraction (XRD) determined the crystallinity of the membrane and tensilestrength for evaluation physical properties. An in vitro study of PVA/GE blendnanofibers was conducted. To assay the cytocompatibility and cell behavior onthe PVA/GE blend nanofibrous scaffolds, cell attachment and spreading offibroblasts seeded on the scaffolds were studied. Our results indicate that thePVA/GE blend nanofibrous matrix, particularly the one that contained 20% PVAand 80% GE could be a good candidate for tissue engineering scaffolds, becauseit has an excellent cell attachment and spreading for fibroblast cell.

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