NW-P003

Fabrication of Luminescent Hydroxyapatite Microspheres for Drug Loading and Release

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Hydroxyapatite (Ca10(PO4)6(OH)2, HAP) particles have attracted a great deal of attention in biomedical fields due to their good biocompatibility, bioactivity and fairly broad applications as drug delivery, dental implant, bone cement, and etc. Thus, many researchers have made an effort to add new functionalities such as luminescence, drug delivery, and bone regeneration properties up to HAP powders by controlling their nanostructure as well as composition. In this research, the mesoporous strontium substituted HAP (Sr-HAP) microspheres were synthesized using a hydrothermal method. In this synthesis, aspartic acid monomers were utilized to form microsphere by controlling surface energy of HAP particles and Sr ions were substituted into Ca ion sites, which induced luminescence property in HAP powders. Moreover, the change in the amount of Sr substitution was found to influence the particle size, morphology, and concurrently surface area, which led to changing drug loading as well as drug release property. The amount of Sr influences the morphology, luminescent properties, particle size, surface area cell viability and drug loading property, which are investigated by SEM, TEM, XRD, FTIR, BET, XPS and in vitro test such as MTT assay and drug release test. In particular, the multifunctional Sr-HAP with molar ratios of 0.25 (Sr/(Ca+Sr)) possessed the strongest luminescent property as well as the superior drug loading and sustained release properties that were correspondent with large surface area and pore size. Our study indicates that the fabricated multifunctional Sr-HAP microspheres are quite useful for bone regeneration and drug delivery.

Keywords: Hydroxyapatite, drug loading and release, spherical particle, luminescent

NW-P004

Antibacterial property and characterization of CuSn thin films deposited by RF magnetron co-sputtering method

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CuSn thin films were fabricated by rf magnetron co-sputtering method on the Si(100) substrate for evaluation of the antibacterial effect. The co-sputtering process was performed with different rf powers and sputtering times to regulate the thickness of the films and relative atomic ratio of Cu to Sn. The physicochemical properties of the CuSn thin films were characterized by X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), X-ray induced Auger electron spectroscopy (XAES), Optical microscope (OM), 4-point probe, and antibacterial test. An antibacterial test was conducted with Escherichia coli (E. coli) and Staphylococcus aureus (S. aureus) as changing contact times between CuSn fillms and bacteria suspension. We compared to the crystalline structures of films before sterilization and after sterilization by XRD measurement. The changes of oxidation states of Cu and Sn and the chemical environment of films before and after antibacterial test were investigated with high resolution XPS spectra in the regions of Cu 2p, Cu LMM, and Sn 3d. After antibacterial test, the morphology of the films was checked with an OM images. The electrical properties of the CuSn films such as surface resistance and conductivity were measured by using 4-point probe.

Keywords: co-sputtering, XPS, XAES, antibacterial test