BIOCERAMIC NANO-CALCIUM HYDROXYAPATITE COATINGS ON SILICON SUBTRATES

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Bone is an organic-inorganic ceramic composite containing well-structured collagen fibrils, nanocrystalline, and rod-like inorganic material with length of 25–50 nm. Sequence of bone structure is formed from seven levels of hierarchy and reflects the material and mechanical properties of each component. Hydroxyapatite is chemically related to inorganic component of bone matrix as a complex structure with formula $Ca_{10}(OH)_2(PO_4)_6$ [1].

Applications of this material in various industries and medicine are investigated. Hydroxyapatite synthesized by different methods has different surface morphology and the products also have different chemical properties [2].

We report the sol-gel synthesis and characterization of CHAp thin films on the silicon substrates using the spin-coating technique.

Calcium hydroxyapatite coatings on silicon substrates were formed by the synthesis of calcium carbonate ($CaCO_3$) by sol-gel synthesis using two solutions of different compositions:

an appropriate amount of 2-propanol was mixed with acetylacetone by stirring at room temperature. Calcium nitrate tetrahydrate was added to the solution and stirred until the substance dissolved. Solution was mixed with PVA [3].

an appropriate amount of citric acid was dissolved in 20 ml of distilled water. After dissolution, the temperature was raised to 80 ℃ and calcium acetate monohydrate was added. After dissolving, ethylene glycol was added and stirred for about 1 hour at room temperature. Solution was mixed with PVA [4].

Silicon substrates were coated with 30 layers of each solution. Two silicon substrate coating techniques were used, which differ in the substrate screwing speed. After each coating, the silicon substrate was heated in an oven at 200 °C for 10 minutes and in an oven at 600 °C for 5 hours at a rate of 5 degrees per minute. XRD, Raman spectroscopy, SEM analysis were performed after 10, 20, 30 coatings. Silicon substrates with surface-formed amorphous and crystalline calcium carbonate ($CaCO_3$) were stored in disodium phosphate (Na_2HPO_4) solution for 28 days in a thermostat at 80 °C. Performed by XRD, Raman spectroscopy and SEM analysis. The results of the analysis indicate the formation of hydroxyapatite and other phosphates in the coatings.

References:

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