# Sol-Gel Fabrication of Coatings in the System of $Ti/CaTiO_3/Ca_{10}(PO_4)_6(OH)_2$

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Titanium is widely used as biomedical and dental material because of its excellent biocompatibility and good mechanical properties. In orthopaedics and dentistry applications the most significant drawback of Ti is weak osteoconductivity. In order to enhance this property, various surface modifications were attempted. Most of these attempts employ coating of Ti surface with calcium phosphate ceramic materials, such as calcium hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$; HAP) which possess higher bone-conductivity, thus, calcium hydroxyapatite is a promising bioactive ceramics in orthopaedic applications, as it makes up the major part of the inorganic components of human bones and teeth.

Dip-coating and spin-coating techniques are widely used for the fabrication of HAP coatings on the metallic substrates. However, during the heating of titanium substrates titanium oxide as side phase usually is forming. The formation of titanium oxide does not allow to achieve high quality coatings of HAP. It was recently reported, that the synthesis of sub-layers of $CaTiO_3$ on the Ti substrate promote formation of HAP phase without additional $TiO_2$.

In this work, an aqueous sol-gel chemistry route based on calcium acetate monohydrate as the calcium precursor and titanium isopropoxide as a source of titanium have been developed to prepare calcium titanate intermediate layer on Ti substrate. The citric acid and ethylene glycol were used as complexing and stabilizing agents. Dip-coated Ti substrates with intermediate calcium titanate layers were heated at 650°C for 5 h with heating rate of 1 °C/min. Calcium hydroxyapatite coatings on $Ti/CaTiO_3$ substrate was also prepared by sol-gel method in aqueous solution using dip-coating technique. In the sol-gel process, the mixture of triethanolamine, EDTA and PVA were added as complexing and stabilizing agents. Dip-coated $Ti/CaTiO_3$ substrates were heated at 850 °C for 5 h, with heating rate of 1 °C/min. Different amount of HAP layers (5, 15 and 30) were prepared and characterized by the X-ray diffraction analysis, scanning electron microscopy and contact angle measurements. The phase purity, microstructure and wettability of hydroxyapatite thin films on titanium/calcium titanate substrate were evaluated and discussed.