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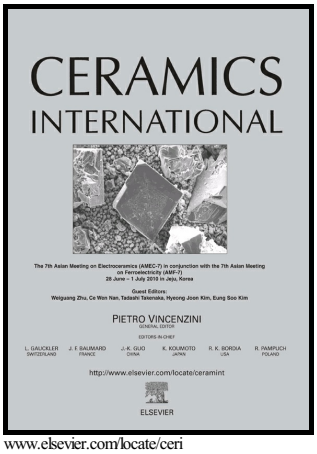

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Biomimetic chitosan-hydroxyapatite hybrid biocoatings for enamel remineralization

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Abstract

Development of biomimetic ceramic-based materials is currently a challenge in dental tissue engineering. Synthetic hybrid chitosan (CS)-hydroxyapatite (HAP) layers are regarded as candidates for teeth remineralization, protection against further demineralization ensuring also antibacterial activity. Thus, the aim of this work was to obtain new biomimetic CS-HAP layers for restoration of damaged mature enamels and to pursue morphological, compositional, structural and hardness modifications of the grown layers by immersion for 4, 7 and 10 days into artificial saliva (AS) under CS-Emdogain (EMD) hydrogel action. SEM-EDX, HRTEM-SAED, FTIR and micro-Raman findings indicated formation of carbonate-substituted HAP, B-type, with c-axis orientation in the newly formed CS-HAP coatings. Prolonged immersion span of 10 days caused increasing CS content in the superficial grown layer while carbonate content diminished. Optimum Ca/P ratio (1.85 at. %) and hardness of 2.48 GPa were recorded for seven days growth using CS-EMD hydrogel. Subtle changes in HAP lattice parameters were recorded for 10-day grown layer while c-axis orientation of HAP crystals at mesoscale was preserved. Mechanism of CS interaction during in situ biomimetic synthesis and self-assembly of HAP crystals under CS-EMD hydrogel presence is also discussed.

Graphical Abstract