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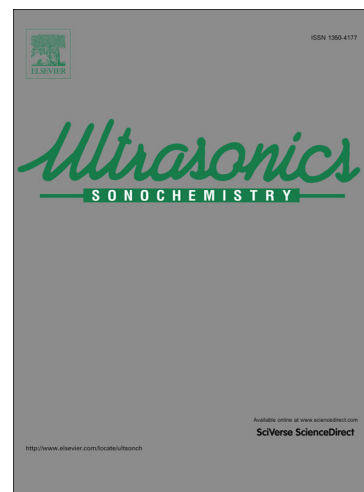
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Effect of employing ultrasonic waves during pulse electrochemical deposition on the characteristics and biocompatibility of calcium phosphate coatings

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Abstract:

In the present work, we investigated the effect of employing ultrasonic waves during pulse electrochemical deposition on surface topography, chemical composition and biocompatibility of calcium phosphate (Ca-P) coatings. The SEM and 3D AFM images showed that the anodized titanium surface was covered with the uniform and refined size of plate-like Ca-P crystals, when the ultrasonic treatment of the electrolyte with power of 60 W was carried out during deposition. In contrast, for the Ca-P; 0 W coating applied under only the magnetic stirring of the electrolyte, the microstructure was non-uniform and some Ca-P crystals with the larger size were randomly observed in different regions, causing a rougher surface. The FTIR results also revealed that employing the ultrasound increases the deposition of a coating involved in only the most stable Ca-P phase of carbonated hydroxyapatite (CHA). However, in the absence of ultrasound, besides the prominent phase of CHA, some less stable Ca-P phases like octa calcium phosphate (OCP) and brushite were also formed in the Ca-P; 0 W coating. The Ca-P; 60 W coating showed the higher ability for apatite biomineralization after a 7-day immersion in the simulated body fluid (SBF). This coating also provided a better surface for the cellular activity, as compared to the Ca-P; 0 W coating.

Keywords: pulse electrochemical deposition, ultrasonic waves, calcium phosphate coating, apatite biomineralization, biocompatibility.

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