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INCREASING HYDROXYL ION CONCENTRATION OF THERMALLY SPRAYED HYDROXYAPATITE COATINGS BY HYDROTHERMAL TREATMENT

HIDROKSILJONU KONCENTRĀCIJAS PAAUGSTINĀŠANA TERMISKI SMIDZINĀTOS HIDROKSILAPATĪTA PĀRKLĀJUMOS AR HIDROTERMISKO METODI

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Hydroxyapatite (HAp, $Ca_{10}(PO_4)_6(OH)_2$) because of its similarity to the inorganic component of natural bone, is widely used as an implant material [1]. Hydroxyapatite has good biocompatibility, but poor mechanical properties, and so it is necessary to improve these properties by combining bioactive HAp on mechanical strong titanium (Ti). Thermal spraying is commercially the most widely used method for producing HAp coatings on metal implants, but it is well known that hydroxyl ions (OH^-) are depleted from the HAp structure after thermal spraying [2]. Therefore, hydrothermal treatment (HT) in watter vapour could be used to return the thermally damaged material to hydroxyapatite crystalline phase [3]. While previous work has only shown qualitative improements, here we shall show quantitative measures of the hydroxyl ion content.

In this research, the effect of HT on the OH^- content was investigated in thermally sprayed HAp coatings. HT was conducted at different temperatures (100–250 °C) and at different times (6–70 h) by placing the HAp coating into a hydrothermal pressure vessel.

Chemical phases and functional groups were obtained with X-ray diffraction and Fourier transform infra-red spectroscopy (FTIR), respectively. The changes in OH^- concentration were detected by calculating the OH/PO_4 area ratio in the 500–700 cm^{-1} FTIR spectral region. Results showed an increase in the OH^- concentration from 2% for as-sprayed coatings to 83% when hydrothermally treated at 200 °C for 12 h). Also, it was determined that the efficiency of HT conversion depends on the phase composition of the coating.

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