

Characterization of Nanophases in HRTEM: Fourier Transform and Simulation

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High resolution transmission electron microscopy (HRTEM) was applied to study the microstructure of biomaterials based on calcium phosphates: α -tricalcium phosphate, octacalcium phosphate (OCP) and hydroxyapatite (HAP). Phase analysis at nanolevel was required to evaluate whether the final product included one or several Ca phosphate modifications. Due to high sensitivity of all these compounds to irradiation of the convergent electron beam such local analysis was performed by processing diffractograms (Fourier transform) from HRTEM images with Digital Micrograph software (Gatan). Interpretation of the experimental results was done by the means of simulation of selected area electron diffraction patterns and HRTEM images using JEMS [1], which allows to perform large calculations of dynamical diffraction patterns and HRTEM images for big multiatomic crystallographic unit cells.

HAP nanocrystals (5-20 nm) randomly oriented relatively to each other were identified in plasma sprayed coatings on different substrates. OCP crystals were found to contain HAP inclusions and their sizes were dependent on crystal growth regime. Phase transformation during high temperature synthesis of α -tricalcium phosphate from the β -form has been studied.

[1] JEMS: <http://cimewww.epfl.ch/people/Stadelmann/jemsWebSite/jems.html>, Stadelmann P..

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