





VOLUME 2b

CHEMISTRY AND TECHNOLOGY OF MATERIALS AND NANOMATERIALS

ABSTRACT BOOK
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CERAMICS BASED ON POWDER MIXTURES, INCLUDING CALCIUM HYDROXYAPATITE AND VARIOUS SODIUM PHOSPHATES

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The calcium hydroxyapatite $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ (HAP) is the main component of the inorganic part of bone tissue. Bioresorbable (not soluble when implanted in the body) ceramics based on HAP is used as a material for bone implants. Regenerative approach of the bone defects treatment requires the creation of a resorbable (soluble when implanted in the body) biocompatible and bioactive ceramic materials, which can be used for fabrication of permeable porous matrix. Such materials can be ceramic composites, and can be the a combination of some bioresorbable phases. It is known that phases such as β -tricalcium phosphate $\text{Ca}_3(\text{PO}_4)_2$ (whitlockite, β -TCP), Na-substituted tricalcium phosphate $\text{Ca}_{10}\text{Na}(\text{PO}_4)_7$ (Na-TCP), rhenanite NaCaPO_4 , double sodium/calcium pyrophosphate $\text{Na}_2\text{CaP}_2\text{O}_7$ and double sodium/calcium polyphosphate $\text{NaCa}(\text{PO}_3)_3$ are biocompatible and bioresorbable.

The task was to create a biocompatible and bioresorbable ceramic composite material comprising these phases. The production of ceramic material was carried out by means of annealing at 900-1200 °C of the workpieces containing the powder of HAP and various sodium phosphates ($\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$, $\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$, $(\text{NaPO}_3)_6$, $\text{Na}_4\text{P}_2\text{O}_7 \cdot 10\text{H}_2\text{O}$) in quantity of 5-25 mol. %. $\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$ and $\text{Na}_4\text{P}_2\text{O}_7 \cdot 10\text{H}_2\text{O}$ were the precursors of the sodium pyrophosphate, and $\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$ and $(\text{NaPO}_3)_6$ were the precursors of sodium polyphosphate in the powder workpiece.

In such powder workpieces obtained by pressing or forming from highly concentrated aqueous suspensions, when heated, various processes take place: destruction and decomposition of temporary technological binder, decomposition of hydrated compounds, formation of condensed phosphates, formation of melts and heterogeneous chemical reactions. As a result of the sintering accompanied with heterogeneous chemical reactions, ceramic composite material in the system $\text{Na}_2\text{O}-\text{CaO}-\text{P}_2\text{O}_5$ is formed.

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