

**ICNTC E-CONFERENCE**  
INTERNATIONAL CONFERENCE ON NEW TRENDS IN CHEMISTRY

**7th INTERNATIONAL CONFERENCE ON NEW TRENDS IN CHEMISTRY**  
**25 - 26 SEPTEMBER 2021**

**7<sup>th</sup> ICNTC BOOK OF ABSTRACTS**

**ICNTC E-CONFERENCE**  
INTERNATIONAL CONFERENCE ON NEW TRENDS IN CHEMISTRY

**7th INTERNATIONAL CONFERENCE ON NEW TRENDS IN CHEMISTRY**

**25 – 26 SEPTEMBER 2021**

<http://www.icntcconference.com/>

**ICNTC E- Conference 2021**

7<sup>th</sup> International Conference on New Trends in Chemistry

Published by the ICNTC Secretariat

Editor:

Assoc. Prof. Dr. Dolunay ŞAKAR DAŞDAN

ICNTC Secretariat

Büyükdere Cad. Ecza sok. Pol Center 4/1 Levent-İstanbul

E-mail: [icntcconference@gmail.com](mailto:icntcconference@gmail.com)

<http://www.icntcconference.com>

Conference organised in collaboration with Monre Academy

**ISBN: 978-605-67476-7-0**

**Copyright @ 2021 ICNTC and Authors  
All Rights Reserved**

**No part of the material protected by this copyright may be reproduced or utilized in any form or by any means electronic or mechanical, including photocopying , recording or by any storage or retrieval system, without written permission from the copyrights owners**

## POWDER MIXTURES OF $\beta$ -TRICALCIUM PHOSPHATE AND POTASSIUM HYDROSULFATE HOMOGENIZED UNDER MECHANICAL ACTIVATION FOR CERAMICS PREPARATION

Tatiana SAFRONOVA<sup>1</sup>, Marat AKHMEDOV<sup>2</sup>, Tatiana SHATALOVA<sup>3</sup>,  
Snezhana TIKHONOVA<sup>4</sup>, Gilyana KAZAKOVA<sup>5</sup>, Maksim KAIMONOV<sup>6</sup>, Alexander  
KNOTKO<sup>7</sup>

<sup>1</sup>Lomonosov Moscow State University, 119991, Russia, Moscow, Leninskie Gory, 1, [t3470641@yandex.ru](mailto:t3470641@yandex.ru)

<sup>2</sup>A.N. Kosygin State University of Russia (Technology. Design. Art), 117997, Russia, Moscow, Sadovnicheskaya str., 33, p. 1, [akhmedov.mm@yandex.ru](mailto:akhmedov.mm@yandex.ru)

<sup>3</sup>Lomonosov Moscow State University, 119991, Russia, Moscow, Leninskie Gory, 1, [shatalovatb@gmail.com](mailto:shatalovatb@gmail.com)

<sup>4</sup>Lomonosov Moscow State University, 119991, Russia, Moscow, Leninskie Gory, 1, [kurbatova.snezhana@yandex.ru](mailto:kurbatova.snezhana@yandex.ru)

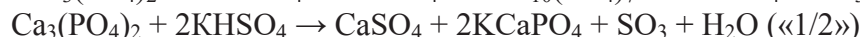
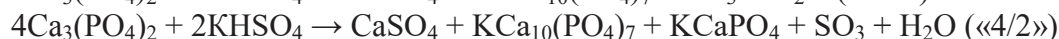
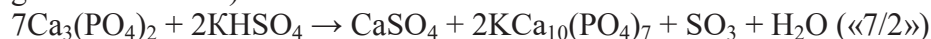
<sup>4</sup>Lomonosov Moscow State University, 119991, Russia, Moscow, Leninskie Gory, 1, [gilyanak@gmail.com](mailto:gilyanak@gmail.com)

<sup>5</sup>Lomonosov Moscow State University, 119991, Russia, Moscow, Leninskie Gory, 1, [m.r.kaimonov@yandex.ru](mailto:m.r.kaimonov@yandex.ru)

<sup>6</sup>Lomonosov Moscow State University, 119991, Russia, Moscow, Leninskie Gory, 1, [alknt@mail.ru](mailto:alknt@mail.ru)

### Abstract

Powder mixtures of  $\beta$ -tricalcium phosphate  $\beta$ -Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> and potassium hydrogen sulfate KHSO<sub>4</sub> homogenized under mechanical activation in acetone medium in planetary mill were used for producing of ceramics in K<sub>2</sub>O-CaO-SO<sub>3</sub>-P<sub>2</sub>O<sub>5</sub> system. Powder mixtures were prepared at molar ratios of Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub>/KHSO<sub>4</sub> established as 7/2, 4/2 and 1/2. The following formal reactions were used for calculation of quantities of starting components to create opportunity of preparation of ceramic composite materials containing calcium sulfate anhydrate CaSO<sub>4</sub> and phases of double calcium potassium phosphates such as potassium-substituted tricalcium phosphate KCa<sub>10</sub>(PO<sub>4</sub>)<sub>7</sub> and potassium rhenanite KCaPO<sub>4</sub> (labeling is given in brackets):



According to XRD analysis data  $\beta$ -tricalcium phosphate  $\beta$ -Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> was the main phase in all powder mixtures after treatment in planetary mill in acetone media. Only powder mixture  $\llcorner 1/2 \llcorner$  has slight quantities of additional phases. K<sub>8</sub>H<sub>9</sub>(SO<sub>4</sub>)<sub>7</sub>PO<sub>4</sub> and K<sub>4</sub>H<sub>5</sub>(SO<sub>4</sub>)<sub>3</sub>PO<sub>4</sub> were found additionally to  $\beta$ -tricalcium phosphate  $\beta$ -Ca<sub>3</sub>(PO<sub>4</sub>)<sub>2</sub> in powder mixture  $\llcorner 1/2 \llcorner$ . Presumably phases of syngenite K<sub>2</sub>Ca(SO<sub>4</sub>)<sub>2</sub>·H<sub>2</sub>O and/or gorgeyite K<sub>2</sub>Ca<sub>5</sub>(SO<sub>4</sub>)<sub>6</sub>·H<sub>2</sub>O presented in powder mixtures in quasi-amorphous form after treatment in planetary mill.

Compacted (P<sub>specific</sub>=100MPa) powder pre-ceramic items based on prepared mixtures were fired at temperature range of 700-900°C for producing ceramic samples. It was found that phase composition of ceramic samples considerably depends on composition of starting powder mixtures. According XRD analysis after firing at 800°C phase composition of ceramic samples  $\llcorner 7/2 \llcorner$  and  $\llcorner 4/2 \llcorner$  contained potassium calcium phosphate Ca<sub>10</sub>K(PO<sub>4</sub>)<sub>7</sub>,  $\beta$ -calcium pyrophosphate  $\beta$ -Ca<sub>2</sub>P<sub>2</sub>O<sub>7</sub> and calciolangbeinite K<sub>2</sub>Ca<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>. Phase composition of ceramic samples  $\llcorner 1/2 \llcorner$  contained calciolangbeinite K<sub>2</sub>Ca<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>,  $\beta$ -calcium pyrophosphate  $\beta$ -Ca<sub>2</sub>P<sub>2</sub>O<sub>7</sub> and potassium sulfate K<sub>2</sub>SO<sub>4</sub>. Up to our knowledge all phases of prepared ceramic samples are biocompatible. It should be noted that potassium sulfate K<sub>2</sub>SO<sub>4</sub> presented in ceramics  $\llcorner 1/2 \llcorner$  is water soluble salt. So additional investigations are required for creation of ceramics in the K<sub>2</sub>O-CaO-SO<sub>3</sub>-P<sub>2</sub>O<sub>5</sub> system for different uses including biomedical purposes.

Acknowledgements: The financial support of RFBR project # 20-03-00550.

**Key Words:** calciolangbeinite; potassium calcium phosphate; potassium sulfate; calcium pyrophosphate; ceramics