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VII INTERNATIONAL CONGRESS VII

ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY EEM2021

BOOK OF ABSTRACTS

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UNDER THE AUSPICES OF

MINISTRY OF SCIENTIFIC AND TECHNOLOGICAL DEVELOPMENT, HIGHER EDUCATION AND INFORMATION SOCIETY OF THE REPUBLIC OF SRPSKA
AND
ACADEMY OF SCIENCES AND ARTS OF THE REPUBLIC OF SRPSKA

JAHORINA, MARCH 17-19, 2021
REPUBLIC OF SRPSKA
BOSNIA AND HERZEGOVINA

PUBLISHER
UNIVERSITY OF EAST SARAJEVO
FACULTY OF TECHNOLOGY
Karakaj 34a, 75 400 Zvornik
Republic of Srpska, B&H
Phone: +387 56 260 190
e-mail: sekretar@tfzv.ues.rs.ba
web:https://eem.tfzv.ues.rs.ba/

FOR PUBLISHER
Dragan Vujadinović, PhD, dean

DOMAIN
ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY

PUBLISHED: 2021

ISBN: 978-99955-81-38-1

UNDER THE AUSPICES OF

Ministry of Scientific and Technological Development, Higher Education and Information Society of the Republic of Srpska

Academy of Sciences and Arts of the Republic of Srpska

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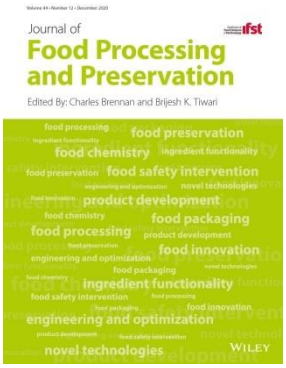

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CIP - Каталогизација у публикацији
Народна и универзитетска библиотека
Републике Српске, Бања Лука

66.02-9(048)(0.034.2)
502/504(048)(0.034.2)
54(048)(0.034.2)

INTERNATIONAL Congress Engineering, Environment and Materials in Process Industry (7 ; 2021 ; Jahorina)
Book of Abstracts / VII International Congress Engineering, Environment and Materials in Process Industry, Jahorina, March 17-19, 2021 ; [editorial board Miladin Gligorić, Dragan Vujadinović, Mirjana Beribaka]. - Onlajn izd. - El. zbornik. - Zvornik : Faculty of Technology, 2021

Sistemski zahtjevi: Nisu navedeni. - Način pristupa (URL): https://eem.tfzv.ues.rs.ba/. - El. publikacija u PDF formatu opsega 273 str. - Nasl. sa naslovnog ekrana. - Opis izvora dana 11.8.2021. - Registar.

ISBN 978-99955-81-38-1

COBISS.RS-ID 131270657

VIII
2021

UNIVERSITY OF EAST SARAJEVO

FACULTY OF TECHNOLOGY ZVORNIK

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REACTIVITY OF POLYPHOSPHATE GLASS IN DIFFERENT MEDIUM

Vladimir S. Topalović[1], Jelena D. Nikolić[1], Veljko V. Savić[1], Srđan D. Matijašević[1], Marija S. Đošić[1], Sonja V. Smiljanić[2,3], Snežana R. Grujić[2]

[1]Institute for Technology of Nuclear and Other Mineral Raw Materials, Franchet d' Esperey 86,11000, Belgrade, Serbia, e-mail address: **v.topalovic@itnms.ac.rs**
[2]Faculty of Technology and Metallurgy, Karnegy 4, 11000, Belgrade, Serbia
[3]Institute "Jožef Stefan", Jamova cesta 39, 1000 Ljubljana, Slovenia

Abstract

Information about the dissolution process and ion release of phosphate glasses in different environments is important for a wide range of engineering applications, from biomaterial design to environmental technologies. The dissolution of glass is a complex phenomenon and the kinetics of this process depend on the glass properties (composition, structure, surface condition, etc.) and environment (the type of solvent, leaching solution volume, pH, temperature, etc.). The dissolution behavior of glass is determined by the reactions of the glass network and the release of different ions to the solution. Surface conditions and layer formation, saturation effects, and solution chemistry must also be taken into account when describing the dissolution processes. Mechanism of chemical reactivity of a polyphosphate glass ($45P_2O_5 \cdot 3SiO_2 \cdot 25K_2O \cdot 15CaO \cdot 10MgO \cdot 1ZnO \cdot 1MnO$ (mol %)) in distilled water, an aqueous solution of 2% citric acid and SBF, under static and non-saturated conditions were presented. The leaching tests were performed with glass powder samples (0.3–0.65 mm) at T=37 °C for times up to 720 h. The mass loss of the samples, the changes of pH, the concentration of elements (P, K, Ca, Mg, Zn, and Mn) in solution, and the initial release rates (r_{0i}) and rate of glass hydrolysis (r_{hi}) were determined. The time dependence of the normalized concentration of ions in solution indicates that the dissolution of examined glass, for all investigated environments, occurs in three stages. For shorter times (stage I), the changes of the normalized concentration of ions in solution were linear with time, corresponding to the highest dissolution rates. During stage II, the changes of the normalized concentration of ions in solution with time were smaller due to lower dissolution rates. In stage III, the changes of the normalized concentration of ions in solution were very small and the dissolution rates were more than ten times lower compared to the initial rates. The initial release rates of cations were determined in the range of 0.17-12.92 g/m^2h. The release rates of cations r_{hi} by hydrolysis were determined in the range of $0.13 \cdot 10^{-2}$-$2.31 \cdot 10^{-2}$ g/m^2h. The time dependence of the solutions' pH is not the same for all of the three solvents. pH value decreased in the initial stage and then remained constant in distilled water and SBF, while in the aqueous solution of 2% citric acid pH value increased in the initial stage and then remained constant.

Keywords: *polyphosphate glass, dissolution, dissolution rate*