Association of Metallurgical Engineers of Serbia
Faculty of Technology and Metallurgy, University of Belgrade
Serbian Foundrymen's Society
Metallurgical Academic Network of SEE Countries
Institute for Technology of Nuclear and Other Mineral Raw Materials
Institute of Chemistry, Technology and Metallurgy
Vinca Institute of Nuclear Sciences

MME SEE 2017

Metallurgical & Materials Engineering Congress of South-East Europe

BOOK OF ABSTRACTS

Editors:

Karlo T. Raić
Dragomir Glišić

June 1-3, 2017
Belgrade, Serbia

Editors:

Karlo T. Raić
Faculty of Technology and Metallurgy, University of Belgrade

Dragomir Glišić
Faculty of Technology and Metallurgy, University of Belgrade

Technical editor:

Department of Printing Engineering
Faculty of Technology and Metallurgy, University of Belgrade

Published by:

Association of Metallurgical Engineers of Serbia (AMES)

Circulation:

150 copies

Printed by:

Department of Printing Engineering Faculty of Technology and Metallurgy
Karnegijeva 4, POB 35-03
11 120 Belgrade, Serbia
Tel: +381 11 3370 492

ISBN 978-86-87183-29-2

Supported by:
The Ministry of Education, Science and Technological Development
Republic of Serbia

General sponsor:

HBIS GROUP Serbia Iron & Steel llc Belgrade

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PREFACE

The Third Metallurgical & Materials Engineering Congress of South-East Europe (MME SEE 2017), organized by Association of Metallurgical Engineers of Serbia and Faculty of Technology and Metallurgy University of Belgrade, takes place in Belgrade, Serbia, 01-03 June 2017. This is a biannual meeting of specialists, scientists and professionals working in the field of metallurgical and materials engineering. The aim of the congress is to present current research results related to processing/structure/property relationships, advances in processing, characterization and applications of modern materials.

The Congress is aided by the Metallurgical Academic Network of SEE Countries, SEE Associations of Metallurgical Engineers and Chambers of Commerce of SEE Countries, Serbian Foundrymen's Society, Institute for Technology of Nuclear and Other Mineral Raw Materials, Institute of Chemistry, Technology and Metallurgy and Vinca Institute of Nuclear Sciences.

The Congress involves together a wide range of related topics and presents the views from both academia and industry. Future of metals/materials industry in South-East European countries; Raw materials; New industrial achievements, developments and trends in metals/materials; Ferrous and nonferrous metals production; Metal forming, casting, refactories and powder metallurgy; New and advanced ceramics, polymers and composites; Characterization and structure of materials; Recycling and waste minimization; Corrosion, coating, and protection of materials; Process control and modelling; Nanotechnology; Sustainable development; Welding; Environmental protection are all covered in the Book of abstracts.

The Editors hope that the Congress will stimulate new ideas and improve the knowledge in the field of metallurgical and materials engineering.

The Editors would like to thank the Scientific and the Organizing Committee, the Congress Secretariat - CONGREXPO d.o.o. and all those who helped in making the Congress a success.
Exceptionally grateful to the sponsors without whom our Congress would not be possible:
1. *General sponsor*: HBIS GROUP Serbia Iron & Steel llc Belgrade
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We would like to express sincere appreciation to the Ministry of Education, Science, and Technological Development of the Republic of Serbia for their endeavor to make this Congress successful.

Editors

ION CONDUCTIVE GLASS-CERAMICS IN THE SYSTEM $Li_2O{\cdot}Al_2O_3{\cdot}GeO_2{\cdot}P_2O_5$

Veljko V. Savić[1], S.D.Matijašević[1], S.R.Grujić [2], V.S.Topalović[1], S.V.Smiljanić[2], J.D.Nikolić [1], S.N. Zildžović[1]

e-mail: (v.savic@itnms.ac.rs)

[1]*Institute for Technology of Nuclear and other Mineral Raw Materials, 86 Franchet d' Esperey St, 1100 Belgrade, Serbia*
[2]*Faculty of Technology and Metallurgy, 4 Karnegijeva St.,11000 Belgrade, Serbia*

Abstract

Lithium based solid electrolytes are mainly useful for utilization in high energy density batteries, supercapacitors, sensors, displays and electrochemical devices. They generally crystallize in rhombohedral R3-c(167) space group related to open structures and the monovalent Li^+ cation can easily migrate in lattice with low activation energy. These materials are usually obtained by powder sintering route and the crystallization of these glasses.

The studies of crystallization of $Li_2O–Al_2O_3–GeO_2–P_2O_5$ glasses showed that one of dominant crystal phase precipitated in glass matrix is NASICON - type $LiGe_2(PO_4)_3$ crystals. It was detected that this glass crystallizes by the volume crystallization mechanism. The enthalpy of crystallization ΔH_{cryst}= -48.36 kJmol^{-1} was determined. The density of the crystalline phase was ρ=3.52 gcm^{-3} and molar volume V_m = 121.09 ·10^{-6} m^3. The ionic conductivity of the test phase which belongs to the solid solutions is about 6.2· 10^{-6} Scm^{-1} at room temperature.

It may be considered that the structure of this glass consists of GeO_6 octahedra and PO_4 tetrahedra. The basic unit of this glass consists of two GeO_6 octahedra and PO_4 tetrahedra corresponding to $[Ge_2(PO_4)]$. Each GeO_6 octahedron is connected to three PO_4 tetrahedra, each of which is linked to four GeO_6 octahedra.

These units in turn are connected to form ′ribbons′ along the *c*-axis and the ribbons are joined together along the *a*-and *b*-axis by PO_4 tetrahedra. This structure results in cavities where lithium ions reside and in bottlenecks in which they pass through.

Keywords: glass, glass-ceramics, nasicon, crystallization