

Dielectric properties of zirconium oxide containing barium titanate glass-ceramics

R. Harizanova^{1*}, K. Krumova¹, P. Takov¹, G. Avdeev², I. Mihailova¹, Tina Tasheva¹, P. Petkov¹, C. Rüssel³

¹University of Chemical Technology and Metallurgy, 8 Kl. Ohridski Blvd., Sofia 1797, Bulgaria

² Bulgarian Academy of Sciences, Institute of Physical Chemistry, Acad. G. Bonchev Str., Sofia 1113, Bulgaria

³Jena University, Otto Schott Institute for Materials Research, Fraunhoferstr. 6, Jena 07745, Germany

***Email:** rharizanova@uctm.edu

Abstract: The preparation of oxide glasses with high concentration of alkaline and alkaline earth oxides is of both theoretical and practical importance. The obtained materials can subsequently be thermally treated and thus, new functional glass-ceramics with potential for electronic, biomedical and sensor applications can be obtained.

The present study is devoted to the synthesis of bulk glasses in the system $\text{Na}_2\text{O}/\text{BaO}/\text{TiO}_2/\text{ZrO}_2/\text{B}_2\text{O}_3/\text{SiO}_2/\text{Al}_2\text{O}_3$ by applying the traditional melt-quenching technique. The as prepared glasses are further subjected to controlled crystallization and thus, glass-ceramics with the desired crystalline phase – barium titanate, BaTiO_3 of Zr-substituted barium titanate, $\text{BaTi}_{1-x}\text{Zr}_x\text{O}_3$ are obtained. The phase composition is studied by X-Ray Diffraction (XRD) and reveals the precipitation of Zr-modified BaTiO_3 . The microstructure is investigated by Scanning Electron Microscopy (SEM) and shows the occurrence of bright crystalline structures containing mainly Ba, Ti and Zr embedded in a dark amorphous matrix. Some of the Zr ions as well as the rest of the elements from the batch composition are detected in the glass matrix. The electric properties are studied by means of Impedance Spectroscopy as a function of frequency and temperature and reveal the occurrence of several relaxor type phase transitions of the Zr-modified BaTiO_3 .

Keywords: Barium-zirconium titanate, Glass-ceramics, Dielectric properties, Relaxor behaviour

Acknowledgement:

The authors are grateful for the financial support to BNSF project KP-06-N78/4.