Morphology and physical properties of porous oxide materials elaborated from relative glasses

Serhii G. Nedilko[1,#], V. Cherevyshnyi[1], V. Chornii[1,2], V. Kurilyuk[1], M. Kremenskoy[1], O. Olikh[1], V. Stasiv[3], Ya. Zhydachevskyy[3]

[1]Taras Shevchenko National University of Kyiv, Kyiv, Ukraine
[2]National University of Life and Environmental Sciences of Ukraine, Kyiv, Ukraine
[4]Institute of Physics of the Polish Academy of Sciences, Warsaw, Poland

The studied porous materials were prepared on the basis of a phosphate-molybdate glass, the manufacturing procedure of which can be found in the work [1]. A certain amount of glass was ground to a fine powder with grain sizes of 10 - 50 μm. A homogeneous mixture of the aforementioned powder with polyvinyl acetate (PVAc) powder was prepared by grinding and then compounded. After that, the obtained pelletized material was annealed at a temperature of ~ 450 C for 4 hours. Further slow cooling to room temperature took place in the same furnace for 18 hours. In this way, a concentration (by PVAc) series of the samples was prepared.

Infrared absorption and Raman spectroscopy were applied to study the structure of the material produced and also to reveal residual traces of PVAc.

A micro hardness measurements showed that the hardness values became strongly lower if compared to the glass pre-cursor samples.

A number of various SEM images showed a formation of the large size, 10 - 50 мкм, pores, while a network of the nanosized pores (10 - 30 nm) was found too.

The volt-ampere characteristics of the manufactured tablets were measured in the direction transverse to their planes in the range from -50 to +50 V and vice versa. The peculiarities of V-A dependences and their correlation with structural and morphological characteristics have been discussed.

The tablets filled with luminescent $SrAl_2O_4$:Eu,Dy oxides allowed visualization of the pores in luminescent microscopes. Moreover luminescent spectroscopy showed the changes in the photoluminescence spectra if compare to the spectra of the ”free” luminescent oxide. Thus manifesting an interaction between oxide and glass-ceramics matrix.

Acknowledgements. The authors are grateful to Kateryna Terebilenko, Doctor of Chemical Sciences (Taras Shevchenko National University of Kyiv) for kindly providing phosphate-molybdate glass for the experiments.

[1] Nedilko S.G., Boyko V., Terebilenko K. et al. [2026] J. Non-Crystalline Solids, 682.

corresponding author: SGNedilko@gmail.com