EXAMINING THE SURFACE MORPHOLOGY OF AEROSOL-BASED MICROPARTICLES COMPRESSED THROUGH UNIAXIAL PRESSING USING IMAGEJ

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Relevance. Sol-gel synthesis of composite micro-powders with a "semiconductor-dielectric" composition is of great interest in many areas, especially optoelectronics and electronics. This novel approach has many benefits and creates new opportunities for the creation of sophisticated materials with customized properties.

Goal of the work – Using Sol-gel structures' diameter pore for crystal structures can be ascertained by the imageJ program.

Result analysis – SiO_2 micro-powders with distinct particle size distributions were created in order to create an analog of xerogel blanks, such as those created through a mixed sol-gel method based on an aqueous dispersion of aerosil of the A-380 brand. Phase contrast was used to transform the microphotograph into a photomicrograph, which was then used to show the "empty" space between agglomerates of SiO_2 nanoparticles. After one hour of annealing in the air at T=800°C, SiO_2:CuO was determined to be the xerogel's phase composition. The dispersion of the sizes of the conditionally "empty" space (black areas, henceforth referred to as nanopores) between the agglomerates of SiO_2 particles that comprise the xerogel matrix, in the range of 0-35 nm with a step of 5 nm, was analyzed for the microphotography. A graphical dependence of the conditional maxima for the computed dispersion of nanopore sizes has been added to the obtained data. An averaged maximum in the region of roughly 16 nm was found by applying the Gaussian smoothing method to the experimental curve (data were processed by the Origin program). Nonetheless, it is possible to see larger nanopores that are at least 50 nm in size. These are caused by the unique ways that the xerogel is only formed from pyrogenic silica particles. The passport data for the produced type of aerosil, which ranges from 5 nm to 20 nm, is consistent with the very size of the primary SiO_2 particles that form the xerogel frame and large particle agglomerates, which is within 20 nm.

Conclusion. Theoretically, freshly prepared (and dried at low temperature) xerogel has a fairly loose and fragile structure, but heat treatment at T = 800-1000 ºC increases the rigidity of its frame and achieves linear shrinkage that satisfies additional requirements for testing formed materials as tableted blanks with specific biologically active components. Four different types of xerogel matrices were obtained in total. First, there are pure xerogels—those devoid of dopants. The second is xerogels with a specific concentration of copper nitrate. The third is copper (II) oxide-containing xerogels. The fourth is reduced copper-containing xerogels. All samples were kept in sealed plastic bags.