

Formation of highly homogeneous optical ceramics compacts by pressure slip casting method

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Ceramics occupies a special place among transparent optical materials (glasses, single crystals, organic materials). This is the rare case when it is possible to combine the main advantages of other materials, while avoiding their inherent disadvantages.

Obtaining optical ceramics is possible by various technologies, but in any case, in a long technological chain there will always be a stage of forming a workpiece, which subsequently turns into the target material.



Fig. 1. Scheme for obtaining highly transparent oxide optical ceramics.

The main problem of the process is an increase in the inhomogeneity of the compact with an increase in the thickness of the workpiece. Therefore, it is almost impossible to form a tablet with a thickness of more than 4 mm with high quality. At the same time, for many practical applications, this parameter should be increased by a factor of 2–3.

Slip casting technology can help solve the problem of scaling the workpiece thickness. The slip-casting technology involves the following main steps:

1. Dilution of slip. Here it is necessary to prepare a suspension containing the powder of that oxide/oxides, the ceramics from which is to be obtained in the volume of some liquid phase. Such a suspension should have a number of precisely fixed physicochemical parameters. First of all, to have the necessary viscosity and Z-potential. That is why the suspension has a complex chemical composition.

2. Pouring the slip into a mold made of hygroscopic material. The most commonly used is gypsum.

3. A long drying process, during which the natural porosity of the mold exerts capillary pressure on the solvent extracted from it. At the same time, a layer of ceramic particles remains on the surface of the mold. To increase the rate of settling of solid-phase particles of the suspension and removal of the liquid phase from the volume of the casting, additional pressure can be applied to the slip, usually transmitted by gas. This modification of the technology is known as "pressure slip-casting" and is widely used in the ceramics industry.

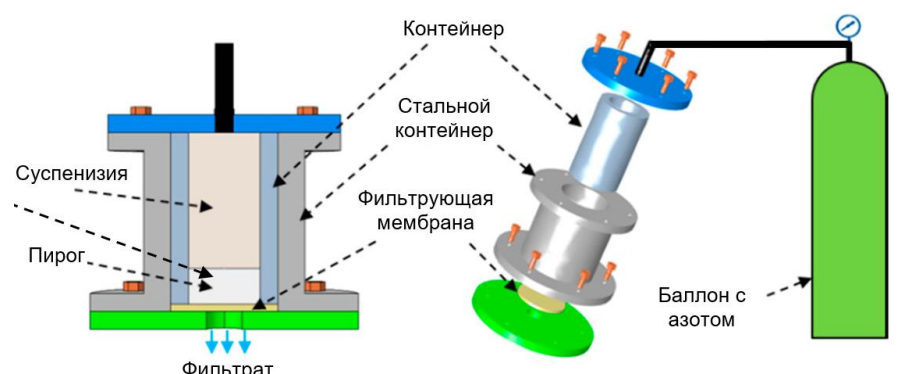


Fig. 2. Diagram of slip casting procedure.