Influence of a Slurry Structure on Structural and Lighting Characteristics of Luminous Coverings for LED Devices

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In the laboratory of technical ceramics and nanomaterials of the Sukhoi Gomel State Technical University in cooperation with the staff of the Department of technology of glass and ceramics BSTU has developed and patented a new composition and method of forming the phosphor coating based on the low-melting glass composition $BaO-Bi_2O_3-B_2O_3-K_2O-SiO_2$ with a melting point of not more than 600 ^oC and nanostructured powder yttrium aluminum garnet doped with cerium, synthesized by the burning of nitric acid salts sucrose, citric or acetic acid, and it is a distinctive feature of the method is the introduction in the composition of the powder silica glass as the diffusion disseminating component improving lighting characteristics.

The luminous composition was prepared by mixing of components with isopropanol, further the slurry was casted on a glass substrate and dried up. The glass substrate with a covering was located in the muffle furnace, gradually heated up to temperature of 650 °C and is maintained within 30-60 min, then slowly cooled with the furnace.

The smooth and grooved glasses were used as a substrate, and also the colored glasses, obtained by the sol-gel method. With use of grooved substrates the process of casting remains almost invariable, and the consumption of a slurry was decreased by 50-60%.

Surface of the luminous coating formed with a filler–silica glass of 0.2 mm in size, was more smooth, contains smaller quantity of imperfections and contains no cracks. Using larger filler (0.5 mm) leads to formation of more rough and non-uniform surface. Thickness of a luminous layer takes on 30-50 microns.

A few types of low fusible oxide glasses were investigated as a basis of luminous coatings: $PbO-Bi_2O_3-SiO_2$, $Bi_2O_3-B_2O_3$, $ZnO-CaO-B_2O_3$. It is established that use of Bi-B-glasses leads to formation of porous structure of a covering and full suppression of a luminescence, and the Zn-B-Ca glasses posses the best compatibility with phosphor powder. The nanostructured powder YAG obtained by a method of burning in citric acid possesses the greatest efficiency of a luminescence and compatibility with low fusible glasses.

The gel-glass substrates doped with transition metals ions can serve as both a color optical filters and coloring of radiation passing through the phosphor layer. We can prepare the luminous converter on different colored substrates - yellow, green, red. The advantage of this approach is the possibility of additional regulation color of radiation passing through the colored substrate coated with a layer of glassy phosphor.