

DIRECT-ON MOLYBDENUM CONTAINING VITREOUS ENAMEL COATINGS FOR HOUSEHOLD APPLIANCES

Oksana Shalygina, PhD, Bojan Spolenak

EMO FRITE Company, Celje, Slovenia
shalyginao@gmail.com

Competition among manufacturers of various household appliances and an increase in demand for this type of product in many countries of the world led to an improvement in their production technologies and an increase in quality, as well as an expansion in the color characteristics of protective and decorative vitreous enamel coatings. Colouring of the vitreous enamel coatings is due to the presence in its composition of coloring agents, in which the spectral curve is characterized by the appearance of a selective or continuous absorption band in the visible region of the spectrum. The coloring agent are differ in the type of dye, the conditions of the process and the mechanism of color of such coatings. In order to expand the color range of direct-on vitreous enamel coatings, various prospecting studies are being carried out, one of the directions of which is the synthesis of compositions containing molybdenum compounds that contribute to damping dark-colored enamel coatings due to the formation of microcrystalline phases of molybdates.

The aim of this work is to develop the composition of molybdenum-containing vitreous enamels to obtain on the parts of household appliances using POESTA powder electrostatic technology, direct-on, pigment-free protective and decorative coatings in gray colors. The choice of molybdenum compounds as coloring agents is due to the possibility of the formation of smaller crystalline phases of molybdates (less 1 μm) of alkaline earth metals, in particular CaMoO_4 and BaMoO_4 , in comparison with the opacifier TiO_2 traditionally used in glass enamels, which form crystalline phases of rutile or anatase with crystal sizes ranging from 1 to 8 μm .

As a basis for direct-on molybdenum containing enamels of gray color, was chosen the previously developed base glass frit (ESB) to obtain black coatings with a component content, mol. %: SiO_2 50–52; B_2O_3 12-15; Na_2O 10-12; K_2O 2-4; CaO 0-2; BaO 2-4; ($\text{MnO}_2 + \text{Fe}_2\text{O}_3 + \text{CuO} + \text{CoO}$) 9-10; CaF_2 2-4.0.

Modification of ESB frit to suppress the black coating with the microcrystalline phase of calcium and barium molybdates was carried out by the phased introduction of MoO_3 from 1.5 to 5 mol. %, which determined the preparation of experimental direct-on coatings in gray colors corresponding to RAL 7026, 7031 and 7033. The melting temperature of the experimental frits was 1260-1280 °C. Coating was fired at a temperature of 820–840 °C for 4 min.

The influence of the concentration of the opacifier agent MoO_3 on the color and performance characteristics of the coatings was established. The optimal concentration of MoO_3 to obtain chemically resistant gray coatings is 1,5-2,5 mol. %. An increase in the concentration of MoO_3 leads to a sharp decrease in the chemical resistance of the coatings, which is unacceptable for this type of product.