Features of structure and phase formation of basalt containing glazes for porcelain tiles

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In the Republic of Belarus, imported glazes are used in the production of ceramic granite tiles. Dependent of producers on imports puts a premium on the developing of glaze compositions using existing local raw materials. This will ensure import substitution and reduction in the cost of production. In this connection, the aim of this study is to evaluate the possibility of using basalt (Republic of Belarus) as a pigment to obtain colored glazes for porcelain stoneware tiles.

As shown by X-ray fluorescence analysis, the main minerals of basaltare plagioclase, clinopyroxene, ore minerals,hlorofeit andolivine.

Raw composition for producing glazes included the following (weight content, %):

- the glazes of the series 1 – basalt – 41–47; frit OR [Levitskii, 2011] – 19–23; dolomite – 12–18, with constant content of technical alumina, kaolin, zinc oxide and refractory clay, total amount 20;
- the glazes of the series 2: basalt – 34–44; copper (II) oxide – 8–14; frit OR – 18–24, with constant content of technical alumina, kaolin, refractory clay and dolomite, total amount 30.

The study of physical-chemical properties founded that synthesized glaze coatings conformed to requirements of technical standards documents, as well as had high decorative effect (Table 1). In addition, all glaze coatings were chemically stable.

Table 1. Physical-chemical properties and decorative-aesthetic characteristics of the glazes

Description	The glazesof the series	
	1	2
Color	Brown	Dark grey, metallic effect
Surface texture	Matte	Matte, semi-matte
Luster, %	9–21	34–43
Microhardness, MPa	7620–10750	5550–7000
The linear thermal expansion coefficient, $\alpha \cdot 10^7, K^{-1}$	56.4–68.6	59.0–73.1
Heat resistance, ºC	150	150
Class of surface abrasionresistance	2–3	1–2

The following crystalline phases were identified in the glazes of the series 2: ($CaO \cdot Al_2O_3 \cdot 2SiO_2$), maghemite ($\gamma$-$Fe_2O_3$) and corundum ($Al_2O_3$). The XRD patterns of the glazes of the series 2 showed tenorite (CuO), cuprite (Cu_2O) and anorthite. The data obtained in the investigation of the structure of glazes by means of electronic microscopy correlated with x-ray phase analysis. Glazes had a solid glass-ceramic structure (Fig. 1).

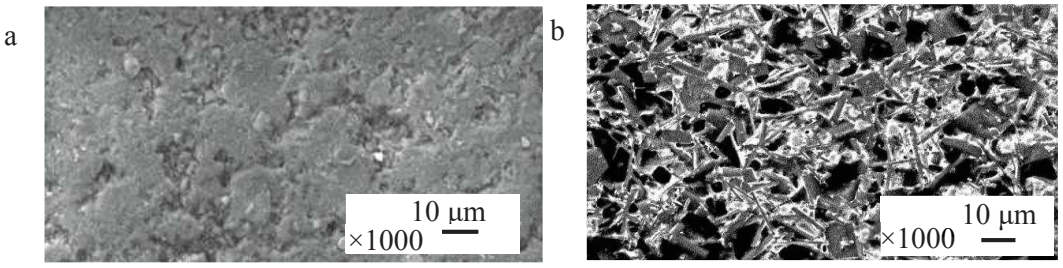

Figure 1. Electronic photographs of a composition-optimized glaze coatings of the series 1 (a), 2 (b)

The tests performed under production plant conditions at Keramin JSC (Minsk, Republic of Belarus) showed that the newly developed coatings can be used in industrial manufacturing.

Levitskii I.A., Barantseva S.E., Lugin V.G., Poznyak A.I. Optimization of the composition of the fritted component of the raw material mix of durable coatings. Glass and ceramics, 2011, 67, 291–294.