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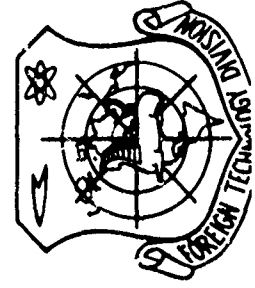
FOREIGN TECHNOLOGY DIVISION



STUDYING THE EFFECT OF A CHANGE IN ALUMINUM OXIDE CONTENT ON THE
PHYSICOCHEMICAL PROPERTIES OF DOLOMITE OPACIFIED GLAZES

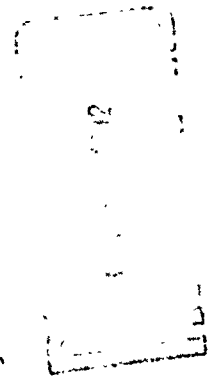
by

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13. ABSTRACT Physicochem. properties were studied with 13 compns. in which Al_2O_3 content was changed from 4 to 20% by proportional changes in other components of the initial glaze. The viscosity and refractory properties of dolomitic opacified glazes increased with increased Al_2O_3 content during formation of frit. With increase in Al_2O_3 content up to 14%, the viscosity of crystd. sample increases gradually from 3.36 to 26.42×10^{10} poises. The further increase in Al_2O_3 content resulted in a sharp increase of viscosity to 81.36×10^{10} poises. The temp. of softening, detd. simultaneously with the coeff. of thermal expansion, increased noticeably ($680-790^\circ$) with increased content of Al_2O_3 . The exptl. coeffs. of thermal expansion of crystd. samples contg. 8-10% of Al_2O_3 at 400° ($61.5-59.0 \times 10^{-7}$) were very similar to coeffs. calcd. from the chem. compn. according to the additive factors. The coeffs. of diffusion reflection (whiteness) of glazed samples after glost firing increased to 77.7-80% with increase in Al_2O_3 content from 4 to 6.5%. It decreased to 72.9% with further increase in Al_2O_3 content. The microhardness of samples increased with increase of Al_2O_3 up to 14% ($100-650$ kg./cm. ²) and then begins to decrease ≈ 604 kg./cm. ²			

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Aluminum Oxide Crystalline Phase Microhardness Thermal Expansion Coefficient Dolomite Opacified Glazes						

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DOLOMITE OPACIFIED GLAZES

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STUDYING THE EFFECT OF A CHANGE IN ALUMINUM
OXIDE CONTENT ON THE PHYSICOCHEMICAL
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Kh. Yunusov, I. Azimov, S. Tashkhodzhayev,
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The effect of aluminum oxide on the quality of glasses and glazes is known [1-4]. However, its effect on the physicochemical properties of glazes in which the thinly dispersed crystalline phases of silicon compounds of alkaline-earth metals are formed has not been studied.

Thirteen compounds in which the Al_2O_3 content varied from 4 to 20 wt. % due to the proportional change in the remaining composite components of the original glaze were studied on the basis of the original glaze X-0 [5].

It was visually established that with an increase in Al_2O_3 content the viscosity and refractoriness of dolomite opacified glazes increases during the frit boiling. During this the crucibles are not corroded with a change in the composition. With an increase in Al_2O_3 content the start (980-1000°C) and the end (1050-1100°C) of the melting point, and also the temperature of the start of spreading (1160-1210°C) of glaze increase insignificantly [5].

By increasing the Al_2O_3 content to 14% the viscosity of crystallized samples increases moderately ($3.36-26.42 \times 10^{10}$ poise) and with further increase in Al_2O_3 it increases sharply to 81.36×10^{10} poise.

The softening temperature determined simultaneously with the thermal expansion coefficient (TEC) [HTP] increases considerably ($680-790^\circ\text{C}$) with an increase in the Al_2O_3 content.

The experimental TEC of the crystallized samples containing 8-10 wt. % of Al_2O_3 at 400°C ($61.5-59.0 \times 10^{-7}$) are very close in their chemical composition to those calculated according to their additive factors of A. A. Appen ($60.74-59.75 \times 10^{-7}$). With an increase or decrease in the Al_2O_3 content the experimental TEC ($40-65.5 \times 10^{-7}$) deviate from those calculated ($54.25-62.32 \times 10^{-7}$). The decrease in TEC is insignificant ($73.6-63.8 \times 10^{-7}$) at the softening temperature of the samples with increase in Al_2O_3 content, for example at 400°C .

The coefficient of diffusion reflection (whiteness) of glazed samples after glost firing increases to (77.7-80.0%) with a change in Al_2O_3 content from 4 to 6.5 wt. % and with further increase in Al_2O_3 content, it decreases to 72.9%. In this case, the glost of the samples changes along the flat curve and the maximum is observed with the Al_2O_3 content of 9% (11.1 is the number of glost). With increase of Al_2O_3 in the composition the maximum deviation in the reflection coefficients (degree of yellowness) at wavelengths of 400-750 nm increases considerably (5-26.5).

With an increase in Al_2O_3 content up to 14 wt. %, the microhardness of samples increases to ($506-652 \text{ kg/mm}^2$) and then begins to decrease (to 604 kg/mm^2).

All studied compounds regardless of the amount of Al_2O_3 and the presence of the crystalline phase of the opacifier are chemically stable in acids and alkalies (97.72-99.96%).

The X-ray phase analysis of the glazes crystallized by 20-hour holding at 1050°C has shown that by increasing the Al_2O_3 content to 14 wt. % a predominately crystalline phase, diopside $\text{CaO}\cdot\text{MgO}\cdot 2\text{SiO}_2$, is precipitated (characteristic lines of the interlayer distances are 2.97; 2.51; 1.619; 1.415), and with a further increase in their Al_2O_3 content up to 20% a mineral mixture, diopside and anorthite $\text{Ca}\{\text{Al}_2\text{Si}_2\text{O}_8\}$ [6] (characteristic lines of the interlayer distances are 3.16; 2.49; 2.12; 1.753), is precipitated, which is confirmed by crystallooptic observation under a microscope.

The refractive index of the crystalline phase was established only for the compounds containing up to 14% of Al_2O_3 where the crystals of the diopside mineral were present ($N_p = 1.667$; $N_g = 1.698$). Beyond this limit, with the exception of dioxide, new compounds appeared which prevented us from accurately establishing the refractive index of the crystalline phase of glaze.

As a result of the visual examination of the samples after they have been fired in the gradient furnace at the temperature range of 600-1200°C, it was established that the temperatures at which the samples begin to bake (640-800°C) and the glaze begins to appear (755-830°C), and also of the start (820-890°C) and the end (1070-1200°C) of the firing period increase evenly with an increase in Al_2O_3 content, which is additional confirmation of the fusibility and softening temperature of the compounds.

The visual examination of the glazed samples after the glaze firing (1050°C) indicates that the change in the content of Al_2O_3 in the compound does not significantly influence the quality of glazed coatings with the exception of the degree of opacification. The latter has a good rating when the Al_2O_3 content is within the 6-12 wt. % range.

Conclusions

1. Up to certain limits (up to 14 wt. %) the Al_2O_3 in a glaze compound is only a component forming glass. In addition to the crystalline opacified glazed phase of the diopside, a new mineral, anorthite, is precipitated when the Al_2O_3 content is increased.

2. In order to obtain the faience glazes opacified with the diopside crystals at a temperature of glost firing of $1050^\circ C$ and having high physicochemical properties, the maximum Al_2O_3 content can be in the range of 6-10 wt. %.

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