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**USE OF ALTERNATIVE HIGH-SILICA RAW MATERIALS IN**

**GLASS PRODUCTION PROCESSES**

Given that the reserves of high-quality quartz sands required for glassmaking are limited, there is a need to find alternative raw materials for introducing SiO2 into silicate glass. Such materials can be low-grade sands or high-silica rocks [1, 2]. Researchers also pay much attention to unconventional methods of glass charge preparation [3, 4]. These include the precipitation method, hydrothermal charge production, and chemically activated charge production. The charge produced in this way has a number of advantages: high homogeneity, increased reactivity and low-temperature melting [1, 5]. They are produced using alkali-silicate solutions or liquid glass [3]. At present, natural quartz sand containing 98-99% SiO2 and a minimum amount of impurities is mainly used as a raw material for the production of alkaline-silicate solution by the hydrothermal method [6]. The use of high-silica rocks for the introduction of SiO2 into glass has been little studied. Although Ukraine has large deposits of high-silica rocks.

The purpose of this paper was to study the processes of leaching SiO2 from the tripoli and obtain the charge by the hydrothermal method. The object of experimental research was the phase transformations and kinetics of glasses based on the amorphous high-silica rock, the tripoli.

The paper substantiates the possibility of expanding the raw material base of glass production through the use of high-silica raw materials - tripoli. The essence of the study is that the introduction of the main component of glass SiO2 occurs at the expense of amorphous silica contained in the tripoli. The charge was prepared by a hydrothermal method. Autoclave treatment of the fired mixture was carried out at a temperature of 150°C for 10 hours at a pressure of 0.5 MPa using NaOH. Thermal analysis of the hydrothermal charge showed that dehydration reactions last up to 500°C, which is explained by the release of chemically bound water of siloxane, silanol and silandiol groups. For the conventional charge, the next end-effect starts at 500°C and reaches a maximum at 540°C, which is due to the dehydration of kaolin and is 40°C higher compared to the similar end-effect of the conventional charge. For the conventional charge, the following exo-effects are observed at temperatures: 610°C, 650°C, 830°C, 940°C. They are caused by the formation of silicates. For the hydrothermal charge sample, we observe only two corresponding exo-effects at temperatures: 580°C, 880°C. The other exo-effects occur at lower temperatures and are superimposed on the pronounced end-effect of water dehydration of siloxane groups. XRD data confirm that the hydrothermal charge at a temperature of 1000°C is practically amorphized, and at 1200°C all reflexes are absent, indicating a 100% glassy state. In the conventional charge, even at a temperature of 1200°C, peaks corresponding to crystalline silica are observed. Visual observation of the stages (fig. 1) of glass formation showed that the heat treatment of hydrothermal charge has significant differences in the temperature intervals of the silicate and glass formation stages.



Fig. 1. Glassmaking kinetics of hydrothermal charge

Studies confirm that the processes of glass formation obtained from hydrothermal charge occur 200ºС lower compared to the processes occurring during cooking of traditional charge.

**Conclusions**

The research validated the advantages of employing a hydrothermal charge with tripoli in the manufacture of container glass compared to an ordinary charge. The hydrothermal method applied for making the charge using the high-silica mineral tripoli allows us to obtain a number of technological advantages. To put it simply, the use of local mineral raw materials and the reduction of dusty component emissions during preparation, transportation, and loading into the glass furnace. In addition, the use of this method allows to reduce the glass melting temperature by 200 ºС compared to ordinary melting.

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