

# Investigation of the possibility of using the raw materials of the Ural region in the production of thermopolished flat glass

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**Abstract.** The research work is devoted to the comparison of two glasses of the same composition but synthesized on different quartz materials – Tashlinsky deposit sand and Ural quartz «Crystal Mountain»), otherwise the same raw materials are used. The physicochemical properties of the obtained glasses were determined, and it was revealed that when quartz is used in glassmaking, the light transmission indicators increase. Therefore, such glasses can be classified as "especially transparent".

## 1 Introduction

Currently, considering the growing demands for the quality of flat glass and the increasing complexity of providing factories with high-quality raw materials, the production of Russian competitive glass products is becoming more problematic. The use of materials from the Ural region in glass production will reduce the cost of transporting materials and, consequently, reduce the cost of raw materials for enterprises in the Middle Urals.

For the manufacture of colorless polished flat glass by the float method, including ultra-transparent, for use in construction, a charge containing quartz sand with a high content of the main product, limestone, dolomite, feldspar, soda, and sodium sulfate is used as glazing [1].

## 2 Methodology and synthesis

Quartz-containing raw materials, the chemical composition of which is presented in Table 1, were used to compare the suitability of glass charge compositions for glass synthesis in laboratory conditions:

- quartz sand, enriched with the highest grade, marki VS-030-V (Tashli Mining and Processing Plant, Ulyanovsk region), the most popular in Russia;
- quartz of the "Crystal Mountain" deposit after magnetic separation (Sverdlovsk region).

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**Table 1.** Chemical composition of quartz-containing raw materials, mass. %

Oxides	Tashlinsky deposit Quartz sand	Quartz Crystal Mountain
SiO <sub>2</sub>	99,75	99,30
Al <sub>2</sub> O <sub>3</sub>	0,10	0,22
Fe <sub>2</sub> O <sub>3</sub>	0,025	0,021
CaO	0,043	0,018
MgO	0,023	0,024
Na <sub>2</sub> O	-	0,005
K <sub>2</sub> O	0,037	0,20
TiO <sub>2</sub>	0,006	0,002
Other	-	0,21

Quartz of the "Crystal Mountain" deposit of selective sampling by chemical composition also meets the requirements of GOST 22551-2019 [2], as well as the best sands of Russia, and can be used in the production of glass under the condition of grinding and grinding. Rhinestone fractions of 0.2 – 0.5 mm is produced today in industrial volumes to produce heat-resistant grouting cements, water filtration, foundry production, sandblasting. In terms of cost, this material is inferior to the Tashlinsky deposit quartz sand, it is not used in glassmaking.

Quartz enriched by magnetic separation from hardware iron after grinding, according to our assumptions, can be used in glassmaking to produce not only sheet glass, but also optical glass, as well as varietal tableware.

For the synthesis of glasses, in addition, dolomite, field spar and limestone of the Ural region, as well as the necessary alkali-containing materials - soda and sodium sulfate. Cooking was carried out in laboratory conditions: in corundum crucibles in a furnace with carbide-silicon heaters, kept at a temperature of 1450-1500°C, cast into steel and graphite molds, annealed at temperatures of 560-570°C (the highest annealing temperature) and 480°C.

### 3 Results and discussion

The synthesized samples turned out to be homogeneous, transparent, and had no color tint (Figure 1). Samples were examined using dilatometry, DSC, XRF, as well as for chemical and thermal stability – for compliance with the requirements for sheet glass [3].



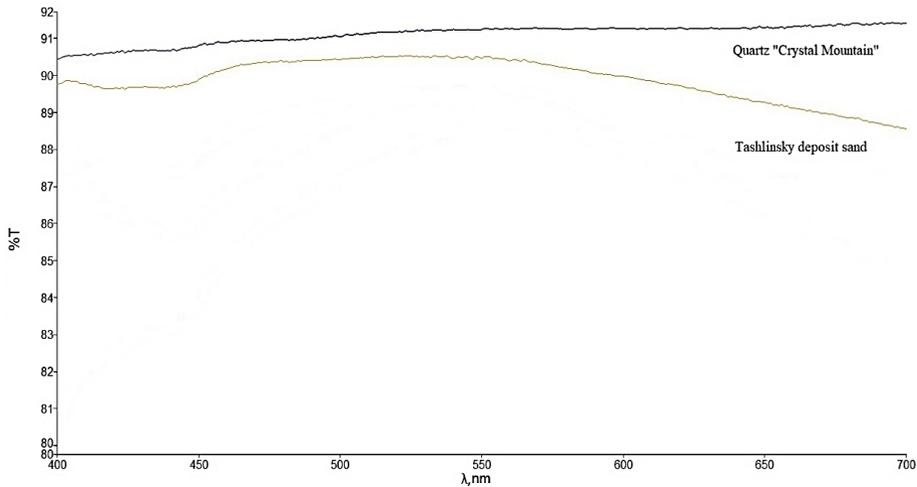
Glass synthesized on the basis of Tashlinsky deposit quartz sand



Glass synthesized on the basis of quartz "Crystal Mountain"

**Fig. 1.** Synthesized glasses samples.

The light transmission of samples processed by grinding and polishing to a thickness of 3-4 mm was measured on the Shimadzu UV-2600 spectrophotometer in the wavelength range of 400-700 nm (Figure 1). Figure 2 shows the dependences of light transmission on the wavelength of visible light.



**Fig. 2.** Light transmission curves.

## 4 Conclusions

The research work showed that the samples based on rhinestone are not inferior in terms of glass synthesized based on Tashlinsky deposit quartz sand, while the light transmission for it was 91.25% at 550 nm, and for glass based on Tashlinsky deposit quartz sand it turned out to be lower, 90.45%. The synthesis of glasses did not involve the use of bleachers [4] to change the redox balance in the glass mass.

As a result of an additional experiment – a minimal addition to the charge with rock crystal of potassium nitrate and cerium oxide – an even higher quality super-transparent glass was obtained.

## References

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