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ANORTHITE CERAMICS PRODUCED WITH PLASMA TECHNOLOGY

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Today, obtaining anorthite ceramics using plasma technologies is an urgent task, as there is an increase in construction volumes and new conditions for building materials and high-quality products. With the help of plasma technologies, today it is possible to obtain a high-quality material with the necessary properties, both physical-mechanical and physicochemical [1, 2].

The following materials were used in this work: lime (CaO), quartz sand (SiO_2) and alumina (Al_2O_3). These oxides are the main ones in the production of ceramic products. They determine the properties and nature of the resulting material.

To obtain anorthite ceramics, the component compositions were selected based on the state diagram [3]. These powder compositions are suitable for the formation of anorthite, as they fall into the field of its crystallization. The component composition is represented by a composition consisting of CaO - 20 wt. %, Al_2O_3 – 37 wt. %, SiO_2 – 43 wt. %.

The scheme of the plasma installation consists of a plasma torch with a remote arc discharge (nozzle diameter 4 mm) installed at a distance of 60 mm from the base of the graphite crucible. Graphite crucible parameters: height 55 mm, diameter 15 mm, wall thickness 3 mm. Melting of 7 g of the material occurred within 30 seconds at: current strength 100 A, voltage 110 V, plasma gas flow rate 14 nl/min (air).

According to this technology, the composition of the component charge was thermally processed. After that, the resulting melt was processed into powder and its phase composition was studied. The obtained data were compared with the data of the original component charge. The resulting radiographs are shown in Fig. 1.

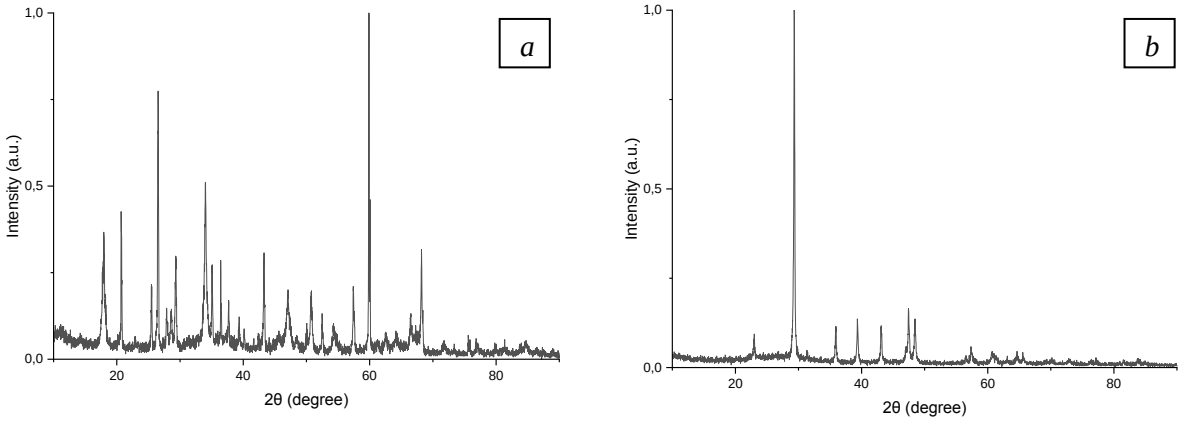

Fig.1. X-ray diffraction patterns of samples: a – component charge; b - melting product

As can be seen from the figure, the obtained X-ray patterns indicate that the phase composition of the component charge (Fig. 1, a) is represented by the phases SiO_2 (d = 0.433; 0.336; 0.263; 0.256;), Al_2O_3 (d = 0.349; 0.154 nm), $CaCO_3$ (d = 0.304; 0.256 nm), as well as some aluminosilicate compounds. The melting product is represented by SiO_2 (d = 0285; 0.229 nm), $CaO{\cdot}Al_2O_3{\cdot}2SiO_2$ (d = 0.170; 0.141; 0.139; 0.121; 0.113 nm).

Thus, the conducted studies have shown the possibility of forming anorthite ceramics using the plasma firing technology.

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REFERENCES

[1] N. Skripnikova, G. Volokitin, M. Semenovykh, V. Shekhovtsov “Features of synthesis of clink minerals under conditions of high-concentrated heat flows”, 7th International Congress on Energy Fluxes and Radiation Effects (EFRE 2020), pp. 769-772, 2020.

[2] Shekhovtsov V., Volokitin O., Skripnikova N., Volokitin G., Semenovykh M. “Thermal plasma in construction industry” IOP Conference Series: Earth and Environmental Science, vol. 688, pp. 012010, 2021.

[3] Shekhovtsov V.V., Skripnikova N.K., Semenovykh M.A., Volokitin O.G. “Anorthite-containing building ceramic using metallurgical sludge waste”, Glass and Ceramics, vol. 78, no. 5-6, pp. 237-241, 2021.