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STRUCTURAL FEATURES OF NATURAL MAGNESITE PROCESSED BY LOW-TEMPERATURE PLASMA

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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 requirements are imposed on building materials and products. With the help of plasma technologies, today it is possible to obtain high-quality material with the necessary properties, both physical-mechanical and physicochemical [1, 2]. From the point of view of the parametric characteristics and structural properties of MgO, it is worth noting the work [3], which emphasizes the use of periclase in the experimental physics of minerals, since its data on pressure-volume-temperature (P–V–T) can be applied to X-ray studies of heated solids. bodies under pressure using tungsten.

The purpose of this work is to evaluate the influence of the temperature factor on the structural and phase changes in natural magnesite ($MgCO_3$) under traditional (1173 K) and ultrahigh (6500 K) heating. Phase quantification plays an important role in the development of phase diagrams, understanding the behavior of MgO under non-environmental conditions, and developing possible applications based on it.

Magnesite $Mg(CO_3)$ was used as the object of study. The average oxide composition is presented (wt %): MgO ~ 46.26; CaO ~ 0.56; SiO_2 ~ 1.50; R_2O_3 ~ 1.51; Δmf ~ 50.24. Cylindrical specimens 35 mm in diameter and 10 mm high were fabricated on the basis of a fraction with a particle size of up to 80 μm. A 10% aqueous solution of liquid glass (Na_2O+SiO_2) was used as a binder. Plasma treatment of the fabricated samples was carried out on an experimental bench [4]. Experimental conditions: current strength 220 A, voltage 130 V, flow rate of plasma-forming gas (air) 0.7 g/s, distance to the sample from the nozzle exit 50 mm, exposure time 3 min. Using the heat flow calorimetric method [5], the mass average plasma temperature at the nozzle exit was 6500 K. The fabricated samples were subjected to a combined approach, including structural-phase analysis using a Shimadzu XRD 7000S, and differential thermal analysis using a TG/DSC analyzer STA 409 PC, NETZSCH.

Qualitative phase analysis of samples M-1173 and M-6500 showed that in both cases the MgO phase of variable composition 0494-MgO, 0495-MgO and 6458-MgO, 6751-MgO is formed. The change in the parameters is insignificant, but in the case of sample treatment at a temperature of 1173 K, the parameters decrease, and at a temperature of 6500 K, on the contrary, they increase. The gratings are stable, the fraction of individual phases in the integrated intensity is 64.91, 35.09 and 71.64, 28.29, respectively. The agreement criteria turned out to be high and equal to R_{wp}=6.6; 11.7%. A complete analysis of the parameters of the etalon lattices, as well as the refined values by the Rietveld method, are presented in Table. one.

As a result of the research, it was found that the main phases of the studied states are the standards $MgCO_3$, MgO in hexagonal and cubic forms. It follows from the analysis of the triplet diagram that $MgCO_3$ is stable with respect to separation into MgO, C, O, and CO_2 phases in the initial state. At the same time, the microstructure of the original sample after isothermal exposure to 1173 K is characterized by acute-angled grains of MgO, the boundaries of the adjoining particles are clearly separated, at the same time, when considering the structure of the surface of the melting product, rounded grains of a prismatic shape are observed, in some areas, sheath-like cellular-dendritic crystals were found on the surface of the grains plagioclase.

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