

carried out for the cordierite obtained at 1350°C from the usual mass, based on the Latnensk clay and magnesite, and cordierite prepared under high-speed firing at 1200°C from a low-temperature mass, based on the Veseloe clay, magnesite, and nepheline syenite with 5% crystallization catalyst.

The structure of usual cordierite (Fig. 4a) is almost totally crystalline. It forms mainly direct-bonded isometric crystals of 1 to 2-3 μm size, which are irregular in shape practically in all cases. Glass interlayers of 0.1-0.5 μm thickness are rarely observed. The cordierite crystals obtained from the low-temperature mass (see Fig. 4b) have prismatic appearance and are 0.5-3 μm in size. The crystals are directly bonded with each other less compactly than in usual cordierite. The glass interlayers are quite frequent, as a result of which the shape of the crystals tends to be perfect.

Thus, it has been experimentally proven that from alkali-containing masses having the stoichiometric composition of cordierite the latter is synthesized under high-speed firing at 1100-1200°C with 40-50 min soaking at the optimum temperature (1200°C).

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TRANSFORMATIONS OF IRON COMPOUNDS IN RED-BURNING CLAYS ON TREATMENT WITH ORTHOPHOSPHORIC ACID

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At NIIstroikeramika a technological process has been developed to make unglazed ceramic tiles from red-burning clays with whitened surface. A general description of the process can be given in the following manner. The pressed and dried tiles are treated with orthophosphoric acid, dried, and fired [1].

The present article deals with the results of investigations of the physicochemical transformations of iron-containing minerals in ceramic masses when they are treated with orthophosphoric acid. The obtained results form a part of the basis on which the technological process has been developed.

It is known that the red color of shards is caused by the presence of hematite Fe_2O_3 which forms at the time of firing due to iron present either in the lattice structure of clay minerals, mainly hydromica and montmorillonite, or in the form of oxides [goethite $\text{FeO}(\text{OH})$ and hydrogoethite $\text{FeOOH} \cdot n\text{H}_2\text{O}$], sulfites (pyrite Fe_2S_3), or carbonates (siderite FeCO_3).

With the help of x-ray analysis it has been established that in the Veseloe, Nikiforov, and Spass-Kamensk clays, initially at 980°C, before their treatment with orthophosphoric acid only quartz is present as the crystalline phase. In the Nikiforov clay a small amount of hematite is also detected.

After treating the same clay samples with orthophosphoric acid (this ratio of clay: acid was 2:1 or 1:1) and firing them at 980°C the diffraction pattern changed substantially. The x-ray pattern of the Veseloe clay sample showed, besides a reflection at 0.334 nm for quartz, reflections at 0.438, 0.390, 0.412, and 0.254 nm (Fig. 1). The values 0.438 and 0.390 nm correspond to aluminum phosphate in the tridymite form and 0.412 and 0.254 nm to aluminum phosphate in the cristobalite form.

In the x-ray patterns of Nikiforov and Spass-Kamensk clays, along with the above-mentioned reflections, there are also reflections at 0.309 and 0.291 nm or close to them (see Fig. 1). The most distinct are the reflections at 0.309 and 0.291 nm in the x-ray patterns of specimens treated with orthophosphoric acid with clay: acid ratio of 1:1 (see Fig. 1, curves 2 and 3).

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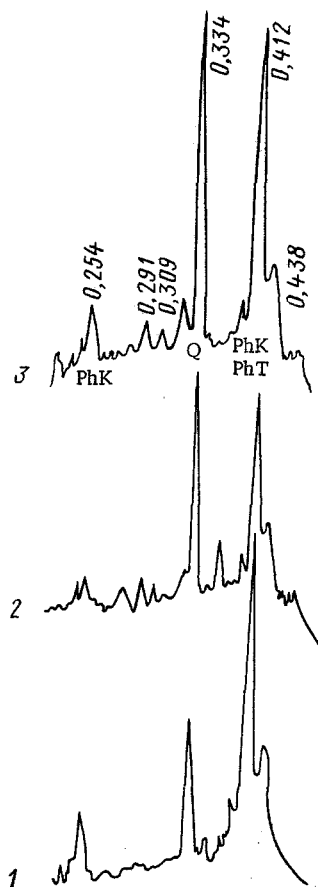


Fig. 1

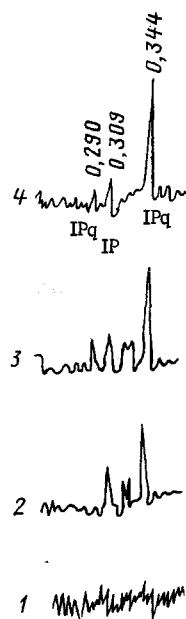


Fig. 2

Fig. 1. X-ray patterns of fired and orthophosphoric-acid-treated Veseloe clay (1), Nikiforov clay (2), and Spass-Kamensk clay (3). Q) Quartz; Phk) aluminum phosphate in the cristobalite form, PhT) aluminum phosphate in the tridymite form.

Fig. 2. X-ray patterns of brown iron ore treated with orthophosphoric acid and fired at 400°C (1), 600°C (2), 800°C (3), and 1000°C (4). IP_q) Iron phosphate in the quartz form and having the formula FePO_4 ; IP) compound Fe_3PO_7 .

It was assumed that the reflections could belong to iron phosphate. For the purposes of their identification x-ray patterns have been taken of brown iron ore in the original state and after treatment with orthophosphoric acid.

Specimens of brown iron ore, treated with orthophosphoric acid, were fired at 400-1000°C. In the x-ray patterns of the specimens (Fig. 2) ignited at 600-1000°C there was appearance of a whole series of reflections that enabled one to differentiate the quartz form of iron phosphate FePO_4 (reflections 0.344 and 0.290 nm) and compound Fe_3PO_7 (reflection 0.309 nm). The comparison of x-ray patterns of Nikiforov and Spass-Kamensk clays, as well as of brown iron ore first treated with orthophosphoric acid and then fired, confirm the presence of the above-mentioned compounds.

The investigations showed that obtaining white ceramic wares from red-burning clays by treating them with orthophosphoric acid is due to the formation of colorless iron phosphates.

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