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Porous Filler of Dacitic Porphyry

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ABSTRACT: In this article analyzed the issues of construction efficiency and reliability of buildings and structures in seismic regions, reducing the mass of the building through the use of lightweight concrete on porous fillers, gaining porous filler from local raw materials and its characteristics, chemical deposits and radiographic researches.

KEYWORDS: Porous, filler, dacitic, porphyry, buildings, materials.

I. INTRODUCTION

Increasing efficiency of construction and reliability of buildings and structures in seismic regions, such as in the Republic of Uzbekistan associated with a decrease in their mass due to the use of lightweight concrete on porous fillers. It is proved that light concretes solve not only technical issues, but also the task of saving material and fuel and energy costs in construction.

However, the lack of raw materials for the production of porous fillers expanded clay, agloporite and perlite, as the most advanced lightweight materials, as well as the production of poor quality agloporite in the Republic of Uzbekistan, restrains the production of lightweight concrete.

Therefore, scientists are seeking unconventional raw materials for the manufacture of lightweight and porous aggregates. In this work, local raw materials will be used, the reserves of which in vast quantities of more than 500 million m^3 are located in the territory of the country and these are dacitic porphyries.

Thus, the problem of producing gainful and efficient porous filler from low-grade raw materials is relevant.

The main task of industrial large-panel construction is to reduce the mass of buildings and, accordingly, products and structures. In this regard, the leading role belongs to lightweight concrete on porous aggregates, allowing reducing the mass of structures and panels up to 50%. This is an economy of raw materials (binder, metal), as well as a decrease in transportation costs. Lightweight concrete accelerates production processes (manufacturing and installation of products) and increasing the heat and sound insulation characteristics of buildings.

In modern construction, lightweight concrete successfully replaces heavy, even in critical structures, both in pre-stressed products that carry a high load, and when operating in seismically active regions like Uzbekistan, Tajikistan, Kazakhstan, Kyrgyzstan, and in other countries.

Usually light concretes are used as heat-insulating, heat-insulating, structural and structural, respectively, according to its classes of strength and density.

In the territory of the Republic of Uzbekistan, Paleozoic glass wool of the perlite type is mainly observed. Not only temperature and the coefficient of expansion, but also the hydration of the glass and the composition of the volatile medium depend on the age of the volcanic glass. However, it should be noted that Paleozoic glasses belong to difficult-to-spin varieties of perlite at a temperature of 1200-13000^{0}C unlike Moldavian volcanic perlites, the expansion process, which is carried out at a temperature of 700-7500^{0}C. Petro graphic studies have shown that glass wool in the Republic of Uzbekistan as a raw material for the production of high-strength aggregate was studied by dacitic porphyry. Their chemical composition is presented in table 1.

The chemical composition of dacitic porphyry

Table1.

Raw	SiO_2	Al_2O_3	TiO_2	CaO	MgO	Fe_2O_3	SO_3	K_2O	Na_2O	n/c	Total
Dacitic porphyry	49,80	15,40	0,31	9,14	3,12	6,11	0,71	6,14	1,14	10,95	100,1

The statistics carried out in table 1 shows that a large percentage of carbonates and iron oxide, potassium and feldspar are contained in dacitic porphyries, so K_2O contains 6.14%. Large mass loss during calcinations allows judging the content of hydrate compounds of perlite rocks.

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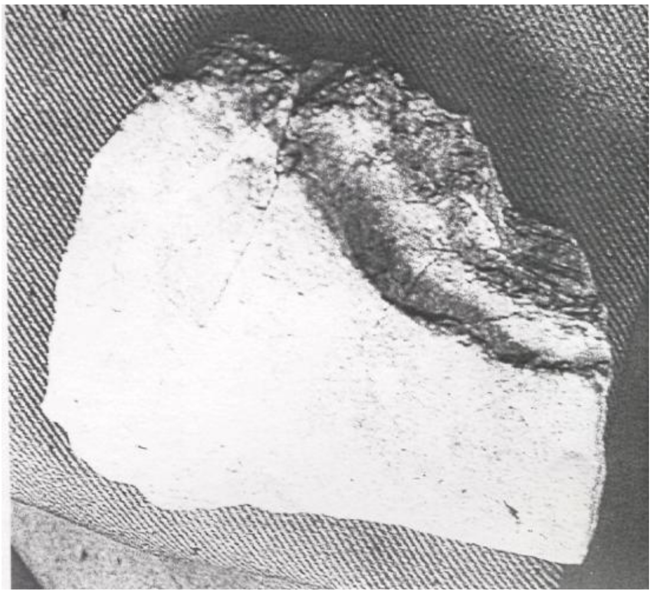
Petro graphic analysis of dacitic porphyries showed the attachment of plagioclase, mafic biotitic materials of 0.3-1 mm quartz. The bulk of the rock consists of chlorite, calcite, magmata and apatite. There is no glass in the rock, the structure is layered.

The study of the physic mechanical properties showed that the expansion temperature is 1250-1300 ^{o}C, the bulk density of the sintered material is> 1, and the expansion coefficient is 1.2. The mechanical compressive strength of the rock is perpendicular to the layers of 15.0 MPa, and the strength of the layered structure is 2.5 MPa. However, it should be noted that after the destruction of dacitic rock, up to 90% of flaky crushed stone is formed. Therefore, to use it as a filler for the preparation of concrete is strictly prohibited according to CN (Fig. 1).

Fig.1. Karakiyaareaofplastic structure of dacitic porphyry. General view in a piece of dacitic porphyry.On radiographs of dacitic porphyries (Fig. 2), lines of interlinear distances with d = 0.424 are clearly visible; 0.355; 0.336; 0.297; 0,227; 0.183; 0.153; 0.138 nm; quartz feldspars characteristic of quartz - with d -0,389; 0.347; 0.322; 0.319; 0.297; 0.215 nm; siderite -0.276.



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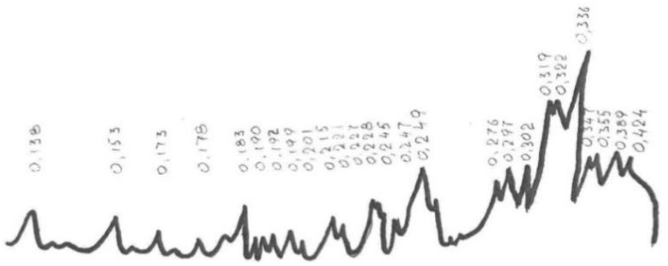

Fig. 2. Radiography of dacitic porphyries

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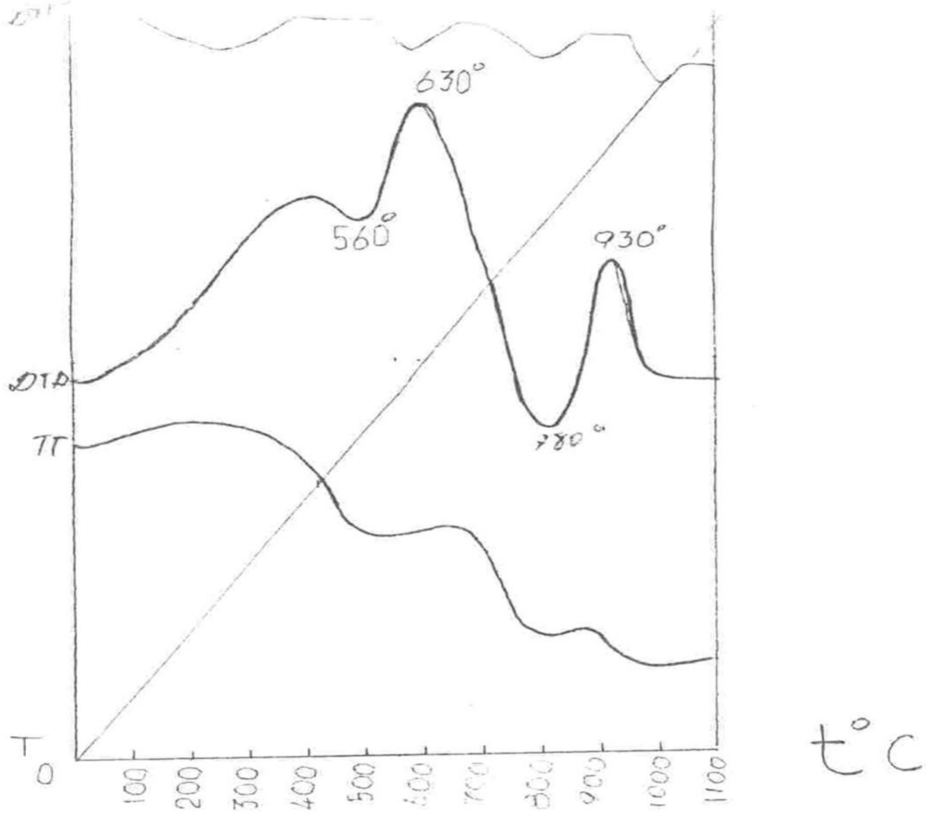

Fig.3. Derivatogram of tacitic porphyry

Derivatogram of taciticporphyry (Fig. 3) showed two endothermic and three exothermic effects. The exothermic effect of 350°C is characteristic of organic burning, and at 630 °C, the effect is associated with the redox reaction of iron oxide, a slight endothermic effect at 560°Cis caused by the dissociation ofFe_2CO_3siderites and the coding transformations of β - quartz into α - quartz. The end effect at a temperature of 780–840 °Cis characteristic of the dissociation of carbonates, and the exoeffect at 930°C decomposition of perlite magmatic minerals into free oxides: 0.249; 0.199; 0.173 nm and carbonates - 0.302; 0.228; 0.192; 0.190 nm.

Therefore, X-ray analysis has established the mineralogical composition of dacitic porphyries, consisting mainly of calcite carbonate CaCO3, hydro minerals in the form of perlite rocks containing chemically bound water, springtide, feldspar and quartz.

According to laboratory research, it is possible to develop a technology and modes for the production of gravel-like porous aggregate. Planning the experimental part of this work, the technological process of the production of expanded clay was taken as the basis, although the objects of study were materials not intumescing, but sintered, i.e. with a decrease in the volume of each granule, dacitic porphyry with caolinite clay, which, as stated, does not swell, but is sintered. However, due to the fact that the sintering process, due to significant heat loss during sintering, cannot ensure the completeness of chemical reactions. Between calcium oxide and oxides of silicon, alumina, iron, potassium, sodium contained in dacitic porphyries, it was necessary to find such sintering unit as a rotary kiln, used for swelling of morillonite raw materials, since the accumulation of heat in such a furnace provides the necessary processes planned in this work.

Conclude the completeness of the physicochemical properties, it is necessary to determine the phase composition. X-ray analysis of the finished product, annealed at 1150 ° C (Fig. 3), showed reflexes with d = 0.423; 0.387; 0.245;0.230nm,characteristic of spinals and cordierite with interplastic distances d = 0,4004; 0.344; 0.265; 0.211; 0.167 nm. In addition, there are peaks with d - 0,424; 0.336; 0,227; 0.182; 0.166; 0.153 nm, characteristic of quartz. Comparison of radiographs of the porous aggregate obtained by agglomeration with the aggregate made using expanded clay technology showed that the peaks characteristic of the neoplasm's in the porous gravel-like mixture slightly increased, causing a more complete chemical interaction between Angren clay, carbonates and Fe_2CO_3 anhydrite. The number of formations has increased due to the fine grinding of raw materials of raw materials. Fig. 3 shows the X-ray diffraction pattern of the baked porous filler of gravel-like form, baked at 1150 °C for 20 minutes. It has increased strength when squeezed in a cylinder (more than 5 MPa), but it reduces water absorption to 12%, especially for small fractions (5 mm). Therefore, we believe that the optimum sintering temperature of the porous aggregate should not exceed 1100 ° C at a shutter speed of 20-25 minutes.

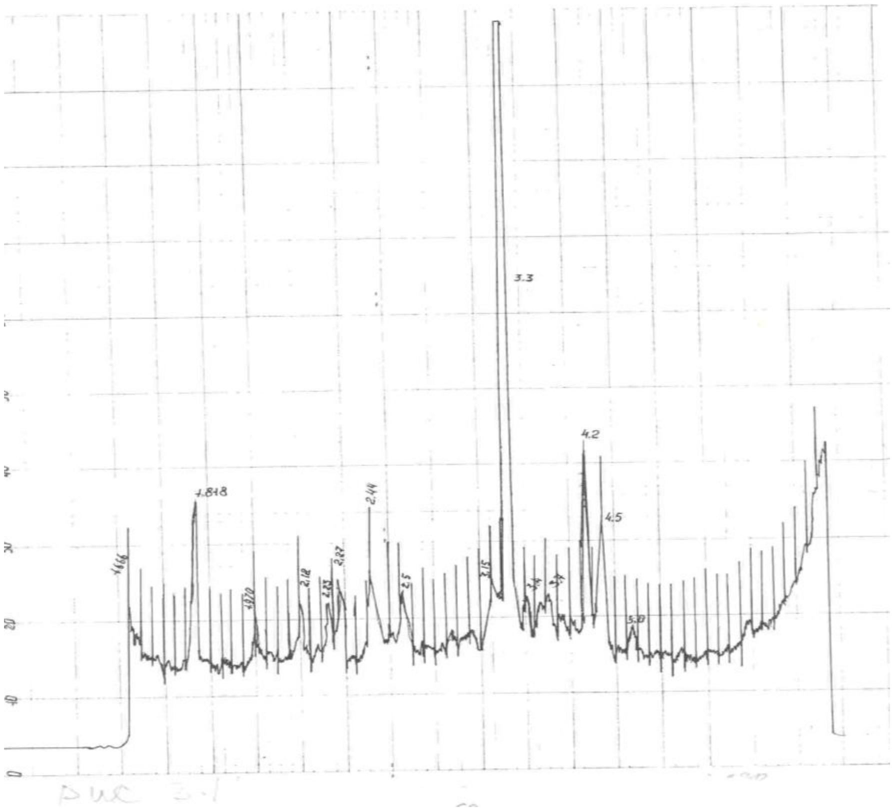

Fig. 4. X-ray diffraction pattern of porous gravel-like filler burned at 1150 °C and aged for 20 minutes.

Figure 4 shows the differential thermal study of porous aggregate calcined at 1150 ° C and a shutter speed of 20 minutes is presented. Two exothermic effects are noted at a temperature of 650–680°C, characteristic mainly of cordierite, at a temperature of 680–730°C of spinal.

A petro graphic study of the phase composition of annealed porous aggregate at a temperature of 1100 °C and a shutter speed of 20 minutes revealed the presence of spinel crystals and caolinite crystals in the transparent section of needle-shaped crystals of ferrous cordierite.

The determination of the chemical activity of porous aggregate for absorption in supersaturated Ca $(OH)^2$ solutions showed that the granules dipped into the solution chemically reacted with calcium hydroxide, since the percentage of the saturated solution decreased. Therefore, the chemical activity of the aggregate and the increase in its strength are determined.

Having studied the sintering kinetics of porous aggregate (Fig. 4), it was established that its high mechanical strength can be ensured with maximum formation of a liquid phase in granules without deformation, can be obtained only by firing the material in rotating furnaces, and not on sintering machines.

II. CONCLUSIONS

Composition of the mixture of dacitic porphyries 80-85-90% of carbonized kaolin clay in an amount of 20-15-10% made it possible to obtain a new gravel-like filler, calcined at a temperature of 1150 ° C and holding for 20 minutes. Carbonized caolinite clay is an integral part of the charge and at the same time is steam-forming. The three

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filler compositions studied satisfy the constructions norms requirement for the quality of expanded clay. The developed technology was tested under production conditions and selected with the smallest addition of 10% carbonized clay. The spherical filler was investigated according to constructions norms, X-ray phase composition, showed stable and durable phasyspine and cordierite.

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