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PROSPECTS OF CERAMIC MATERIALS

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Annotation: In this article, the prospects of ceramic composite materials, mining and transportation of raw materials, technological processes of obtaining ceramics and refractory materials, production of artificial ceramics, types of ceramics, methods of ceramic production, porcelain production, types of porcelain and its components, elegant ceramic products, construction ceramic products, properties of construction glass, technological processes of glass and glass production are widely covered.

Keywords: Ceramics, spool, sitall, porcelain, briquettes, molding, sorting, packaging, fine ceramics, technical ceramics, construction ceramics, construction glass, refractory materials

INTRODUCTION: Currently, in the economic and social development plans of our independent country, special attention is paid to increasing the quantity of products produced by the chemical, building materials and metallurgical industries, bringing their quality to world standards, and strengthening their export potential. Since the quality of the produced materials and products mainly depends on the improvement of these processes and factors, ceramic materials have a special place. Ceramic materials are distinguished by corrosion resistance, hardness and strength

Extraction and transportation of raw materials.

Mining of raw materials and clay is carried out in open shallow mines near the enterprise. First, the surface of the quarry is cleared of vegetation, gray soil, and limestone residue using a scraper, bulldozer, or excavator, drainage ditches are removed, and an access road for vehicles is constructed. Then, digging and loading of clay into vehicles is carried out using different methods, open in warm climates and closed in cold winters. Single-bucket and multi-bucket excavators with a bucket volume of 0.5-2 m^3 are usually used for these purposes.[1]

Ceramic products include building bricks, ceramic products, porcelain, refractory material, technical ceramic products, construction and technical glass, crystal, glass-crystal, gypsum, lime cement and other binders, phosphoric, potassium, nitrogenous, complex substances are included. Ceramic products are solid state with poly and monocrystalline structure. Glass products have a solid and non-crystalline structure. Ceramics and glass products are primarily based on silicates. 75% of the earth's crust consists of silicates and 12% of silica. Ceramics and glass are obtained from various raw materials by firing and melting. Therefore, their properties are variable and are classified as follows.The basis of the production technology of ceramics and refractory materials, as well as glass and steel products, is the transformation of natural or artificial raw materials and material powder into a technical monolithic stone, distinguished by complex properties to a certain extent. Some parts of ceramics and glass technology can be described schematically as follows:

Scheme of technology of ceramics and refractory materials:

Raw materials —> preparation of powder, plastic mass or slinker —> molding —> drying —> incineration — thermal, mechanical or chemical treatment —> sorting —> packing — warehouse of finished goods.

The scheme of the technology of glass and citals:

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Raw materials —> preparation of powder or briquettes —> melting molding —> thermal mechanical or chemical treatment —> sorting —> packaging — warehouse of finished goods. [2]



Figure 1. Glass and steel products

Clay, loess, feldspar, sand and fireclay, and sand, limestone, and soda are used in the production of ceramics and refractory materials. There are many similarities in the types of raw materials used in the production of various silicate products, and their ratio and type depend on the characteristics of the manufactured products. For example: in the production of building bricks, porous and porous porous bricks, raw materials that are easily liquefiable and resistant to temperatures below 1620 K are used. Various additives - quartz or quartz sand, iron oxides, limestone particles and organic compounds cause them to liquefy at a lower temperature. Refractory clays are used to obtain refractory materials. They are clean compared to easily liquefiable clays, and because of relatively less mixing of quartz, feldspar, mica, iron compounds, etc., they withstand temperatures above 1850 K.The third type of clays, difficult to liquefy clays, liquefies at 1620-1850 K. Due to the fact that there are more mechanical additives than in fire-resistant clays, fire-resistant bricks cannot be obtained. They are mainly used in the production of sewage pipes, floor and interior finishing tiles, and facade ceramics. One of the main technological operations in the production of silicate products is the preparation of raw materials, which is carried out by wet or dry methods.When raw materials are prepared in water, the production method is called "wet" method.

The main task of preparing materials is to create a homogeneous mixture of raw materials with the required moisture and chemical, mineralogical and granulometric composition. To prepare such a mixture, the materials included in the composition, such as limestone, clay, feldspar, corrective additives, are crushed and thoroughly mixed with a certain amount of water or steam. Raw materials for ceramics and glass technology should be prepared in exactly the same way. Mining of raw materials from the ground, transportation, grading, sorting, dosing, lifting, transfer, mixing, crushing and storage of ready homogeneous raw materials are the main technological operations in production. [3]

A brief history of the production of artificial ceramics.

Pottery is an ancient art, and folk craftsmen have been developing it for centuries. Not only art and household items are made from it, but it also adorns historical monuments, modern houses, structures and avenues. The art of ceramics was also used in the decoration of metro stations. For example, a person entering the Oybek, Navoi and Tashkent stations of the Tashkent metro feels as if he has entered a magnificent palace. Nationality, historicity and modernity are reflected in the pottery samples on the station pillars. The stickiness and heat hardening of clay made from soil have been tested many times by folk artisans. This, in turn, led to the production of the first types of artificial ceramics. According to the information obtained from archeological excavations, our ancestors used egg-shaped flat containers for cooking, storing water and drinks as early as the end of the Stone Age - the Neolithic period. [4]

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In the history of our country, among the ceramic monuments of the Middle Ages, you can find many practical objects found in Chust and Dalvarzin of the Ferghana Valley, Sopoltepa and Kuchuktepa of the Surkhandarya region, Afrosiyob of Samarkand, Khorezm and Tashkent, where craftsmen lived. Such ceramic dishes amaze people with their hardness, uniqueness of the pattern, and elegant processing. By the 20th century, Uzbekistan paid great attention to the development of all types of ceramic products, including ceramics. Pottery enterprises were established in all regions of our republic. Existing craft workshops in Gijduvon, Rishton, Khiva, Samarkand, Shakhrisabz and Tashkent were re-equipped and expanded.

Types of ceramics.

The clay is alkaline and calcareous depending on the composition of the soil used in ancient times. divided into iron and other types. It was customary to divide finished ceramic products into types depending on their color. It is made in light yellow-red, gray, blue, reddish-brown, black and other colors.



Figure 2. Ceramic products of Rishton, Fergana region

There are many similarities between ancient and modern pottery technology. Since ancient times, Uzbek potters have been making such items from a special "sagiz amoun" that has the same composition and the same color.

Ceramics, like ceramics, are divided into building and industrial construction materials, engineering materials, and household materials.

1. Construction and industrial construction materials include wall and decorative ceramic tiles and other items, ceramic pipes used for sewerage, sanitary-construction ceramic products.

2. Technical materials consist of such products as galvanic element shells, chemically resistant ceramic products, filtering cavity ceramic, light technique ceramic, and metal pouring mold.

3. Household materials and items include ceramic household utensils (plates, bowls, tea plates, bowls, etc.) and art-decorative items (children's playpens, hay cups, large sculptures, vases, etc.).

Ceramic products are classified according to the type of raw materials used in the chemical and mineralogical composition of the product. For example, depending on the type and amount of raw materials, they are divided into clay tiles, lime tiles, hard tiles, fireclay tiles and semi-porcelains.

faience products are ancient and are known as pottery products. If they are glazed and decorated with flowers, they are called glazed vase pottery. The composition of these products

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included 80-85% high-temperature melting clay and 15-20% burnt flint. In some cases, porcelain clay is added to the composition to increase the whiteness of the products. Natural quartz and sand can be used instead of flint. Earthen faience mass can be colored, flowing and yellowish. The glaze that is applied to it consists of a special solution prepared on the basis of easily soluble transparent or hard silicates. Its clay is dense and firm. Lime faience is also known as soft faience or medieval faience. This type of faience includes "Turkish" faience and semi-faience products. These products are based on Persian pottery of the 10th-18th centuries AD, which contained 30-40% clay, 30-50% quartz, 0-10% feldspar, and 10-15% limestone. In some places, dolomite mineral was used instead of limestone. Usually their surface is covered with glaze containing lead oxide. The glaze used can be colored, white or transparent. [5]

Solid earthenware occupies an important place among earthenware. This type of faience is also called feldspar faience. At the beginning of the 18th century, German craftsmen were the first to discover such ceramics. Their mass includes 45-65% gray clay, 25-40% sandstone and 8-15% feldspar. Gilmoya can be partially replaced by porcelain clay, and feldspar by production waste. A large amount of fireclay is added to the composition of fireclay tiles. Fireclay, in turn, is obtained by heating clay or other clay rich in aluminum (III) oxide at high temperature for several hours. A thick angob is applied to the surface of the fireclay, followed by an opaque glaze. Usually this raw material should be oily and sticky. 25-45% fireclay is included in the fireclay faience mass called Fayerton. The size of the particles of this substance added to the oily clay should be in the range of 2-5 mm. 4% of pegmatite, 18% of sand, 3% of highly viscous clay and 0.1% of soda can be added to the composition of the mass. In the production of semi-ceramic products, the same raw materials are used as in solid tiles. It is an intermediate material between solid faience and porcelain in terms of sanitary-hygiene and mechanics. Usually, semi-porcelain contains 48-50% clay and kaolin, 40-50% quartz and 5-10% feldspar. The incineration process of molded raw products can be improved by adding 30-60% barite mineral to the mass. Such a product is known as barite tiles. Bentonite clay, which increases the viscosity by 10-15%, is added to pure soil to make earthenware. This increases the product's tensile strength and is called bentonite faience.

Ceramic products are divided into parts, groups and types based on the method of preparation, type of processing, structure, viscosity of solid fine particles, glazeability, acid stability and other similar factors. According to the method of preparation, the products are divided into slimer or melt-cast and plastic-molded products, as well as glazed and non-glazed products according to their outer surface.

Ceramic production methods.

Nowadays, ceramic mass is made in different ways. The first method is the most ancient, and according to this method, a liquid substance is prepared - a slicker intended for casting. The moisture content of this sugary substance is 31-32%. The second method is widely used in development, experts call it the plastic method. According to this method, a plastic mass with a moisture content of 16-25% is prepared, and the necessary shapes are formed in the molds. According to the third method, a fiber-conical mass with a moisture content of 5-8% is prepared.

In enterprises, the pouring of the slip into molds is often done without the help of mechanization. Due to this, the pressure in molding will not be higher than one atmosphere. Semi-dry powder with a moisture content of 5-8% is pressed at a pressure of 200-400 kGs/cm^2 in one- or two-way, single-layer or multi-layer methods. The pressing process is performed in elbow-handle, friction, rotary and hydraulic presses. When the humidity of the plastic mass is 16-25%, pressing is carried out in tape or stamp presses at a pressure of 10-20 kGs/cm^2. Usually,

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the finished clay is pushed and compacted in a press using an auger. Another modern production method in the production of ceramic products is called dry pressing. Dry pressing usually uses powder with a moisture content of no more than 2%, and ceramic products are made. So far, this method has not been widely used in the ceramic industry. Ceramic production is a very complex process that includes several stages. Due to the fact that the semi-dry pressing method is carried out under high pressure with the help of various automatic devices, the shape of the pressed items must be simple. Plastic mass molding can be used to make simple or complex shapes. When working with plaster or solution, very complex shaped objects are poured into plaster molds.

In fact, ceramic products such as teapots, mugs, jugs (vases), figurines, toilet bowls, washbasins, etc. are obtained by casting from solutions. Household appliances such as plates, cups, bowls, pipes and plates are made of plastic mass and molded

A brief history of the creation of porcelain.

Many were surprised by the elegance, clear color, sonority, stone hardness, waterproofness and luster of porcelain. Porcelain bowls, bowls, teapots and plates, decorated vases, and figurines have decorated every home since ancient times. The quality of the porcelain product depends primarily on the skill of the engineer-technician and the worker who produces it. It is possible to think about folk art, customs, and national traditions depending on the color given to it, drawn images and patterns. Chinese porcelain was introduced to Koreans and Japanese at the beginning of AD, and Arabs who traded with it in VI-VIII centuries. In the 8th century of the new era, the European peoples through the Arabs got to know porcelain.



Figure 3. Examples of porcelain

Porcelain was valued at a higher price than gold. That's why European potters, glassmakers and alchemists started trying to unravel the secret of this product called “porcelain”, which comes from the Persian word "fegfur" and means "a piece of pottery". The word “Fegfur”, in turn, was derived from the word "fagfur" and meant a Chinese ruler. Despite the presence of many pottery workshops in Central Asia, including Uzbekistan, porcelain production was not well established. In 1947, the Tashkent porcelain factory, the largest enterprise in Central Asia, began to be built. Its first turn was completed in 1951, and it began to provide products necessary for the people. In the first year, 1952, 200,000 pieces of porcelain were produced at the enterprise. Skilled engineers and scientists in the development of porcelain industry in our republic contributions are very large. In particular, the improvement of this field, the improvement of the type and quality of products in enterprises, F. Kh. Tojiev, N. A. Sirojiddinov,

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A. A. Ismatov, M. Yu. Yunusov, A. Kh. Ismailov. A. P. Irkakhodjaeva, A. M. Eminov, Sh. Yu. Azimov, A. A. Ibroh imov, D. I. Maksudov, T. I. Olimjanov and R. Yu. The services of scientists and engineers like Yusupov are great. The type of porcelain and its components. Porcelain products are ceramic and refractory material of silicates.

Technical ceramic products.

The term "technical ceramics" refers to materials that are artificially obtained by heating under certain conditions and have special properties. They are all elements, oxides and substances included in D. I. Mendeleev's periodic system can be obtained on the basis of and have different chemical and spatial composition. Despite the large number of types and production methods of technical ceramic products, there are signs that connect them to one class. Such signs include those in tune:

use of oxide, salt and other artificially obtained chemical compounds as main raw materials;

high purity of raw materials;

that the raw materials obtained by mechanical and chemical methods consist of very small dispersed particles;

high dosage of the components included in the frost;

plasticizer - additives (various alcohols and dicarboxylic acid esters) have been added to improve molding of products;

the combustion process is carried out in a highly regulated and regulated gas environment;

the use of non-traditional devices and equipment in the production process;

In the following years, technical ceramic products began to be produced on the basis of chemical compounds with high and chemical stability. Among such products, first of all, aluminum oxide—Al_20_3

Fine ceramic products.

Materials with a dense grain texture, formed by molding and firing compounds with a certain level of moisture, created by adding quartz, feldspar or boron to natural clay, are called fine ceramic materials. Among such materials, first of all, ceramic and porcelain products are included. The water absorption of ceramic or earthenware is 9-21%, while this indicator of porcelain is around 0.5-0%. The material formed between faience and porcelain is called semi-porcelain. Its water absorption is 3-7%.

Among the fine ceramic products is majolica. Such items are made on the basis of colored natural clay and have a rough surface. It is covered with potassium glaze. Ceramics were first called "faience" thanks to majolica, which developed in Faenza, Italy in the 15th century. Items belonging to the faience group are divided into three subgroups - household items, ceramic tiles used to cover the surfaces of items, and sanitary-technical items. Like faience or ceramic semi-porcelain and porcelain products, they are made of clay, feldspar and quartz, but differ in the proportion of raw materials (Table 1).

Table 1

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Raw material type	Amount in mass, %		
	Hard; faience	Half Porcelain	Sanitation Porcelain
Turns white when burned clays and kaolins	50-55	48-50	45-50
Feldspar or its substitute pressing raw materials	5-10	7-12	18-22
Quartz, quartz sand or their substitutes	40-50	40-45	30-35

Due to differences in raw materials ratio and technological process, their physical and mechanical parameters are also different (Table 5).

Physico-mechanical indicators	Solid faience	Semi-porcelain	sanitary porcelain
Water absorption, %	10-12	3-5	0,2-0,5
Volumetric weight, kg/m^3	1920-1960	2000-2200	2250-2300
Compressive strength MPa	100	150-200	500
Flexural strength MPa	15-30	38-40	70-80

Thus, the first representative of elegant ceramic products is ceramic, which is widely distributed in the world and the production technology is somewhat simpler compared to porcelain. Ceramic products are distinguished by the porosity of their bodies. Its crust is white and porous, and its surface is covered with a layer of transparent glaze. If it is not glazed, it will absorb water.

Construction ceramic products.

Construction ceramic materials and products include substances obtained on the basis of large and small-grained ceramic masses, used in the construction of housing, industrial enterprises, various engineering structures, roads, water and sewage networks. At the same time, building ceramics are widely used in the construction of structures serving science and technology, gardens and parks, and various fields.

Building ceramics are divided into two large groups according to their technological characteristics.

1. The first – “A” group includes ceramic products with water absorption less than 7%.

2. The second – “B” group includes products with a water absorption of more than 7%.

Construction ceramics belong to the group of traditional ceramics, which include the following products widely used in industrial and civil construction:

• wall ceramic materials - ordinary building bricks, etc.;

• tombop ceramic materials — cherepitsa;

• Tashkoy surface ceramic materials — surface stone tiles, architectural-art objects, colorful, patterned glitter tiles or gisht tiles.

• interior finishing materials — glazed tiles with faience, floor tiles, etc.;

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• effective fillers - expanded clay, perlite, agloporite, gravel, etc.;

• sanitary ware - bathtubs, sinks, urinals, toilets, etc.;

• ceramic pipes - products used for sewage and drainage purposes.

Construction ceramics are mainly fired products, porous (precious materials, architectural finishing ceramics, decorative ceramics, tiles, thermal insulation, etc.) and stone ceramics (sewage pipes, acid-resistant pipes and products, used for flooring tile) is divided into

Properties of construction glass.

The development of glass, including construction glass, is inextricably linked with the development of society, and construction glass has been gaining great importance in human life since ancient times with its positive properties. It differs from rare metals, minerals and other rocks by its unique properties:

1. Transparency.

2. It is chemically tough, i.e. neither rain, nor cold, nor wind, nor sunlight affect the glass products.

Currently, there are very few substances that can compete with construction glass. Chemical hardeners can be found in many natural and man-made crystalline materials, but the role of an alloy that is as transparent as building glass and widely available and inexpensive is unmatched.

Construction glass has been around for centuries, mostly for peaceful purposes. Residential, cultural and household institutions and production enterprises have been made light, comfortable and attractive from construction glass. Modern architecture is promoting glass as a construction and decoration material. For this reason, the use of rolled glass, porous glass blocks, profiled glass and carpet mosaic tiles in production and construction is increasing day by day. Cital by crystallizing them in a special way. The acquisition of technical products such as photositall and slakosittall is also underway.

Division according to its properties.

According to their properties, they are divided into ceramics and glass materials, as well as glass and ceramics. Materials for ceramics and grass, products necessary for the production of products, are divided into three groups:

1. Traditional ceramics (building and elegant ceramics).

2. Technical ceramics (refractory high oxide ceramics, silicate and aluminosilicate ceramics, titanate, ferrite, carbide, nitride, boride and silicide ceramics).

3. Refractory semi-materials (with creamnesium-dynasium and quartz; aluminosilicate-sour, fireclay and high-glinasium; magnesium-magnesite, dolomite, forsterite and spinel; chrome-chromite, chrome magnesite and magnesite and magnesite and magnesite; - coke and graphite Oxidized - special oxide; oxygen is composed of carborundum and place). The products of the second part are combined on the basis of "Shzaisha and sital technology".

1. Glass construction (window, glass, laminated glass, profiled glass, shatterproof glass, decorative colored glass, glass block foam glass, fiberglass).

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2. Technology (optics, light equipment, electronics, electrical insulation, chemical laboratory, ampoule medical and quartz bottles.

3. Household bottles (crystal, colored and colorless glass, glass mirror, decorative, etc.).

Depending on the type of raw material, the sieves are technical sieves (photositull, cement sieve, cordierite, lead sieve, etc.)

Division by fields of application.

According to the application of materials, ceramics and glass are divided into three large parts:

1) building and industrial construction materials;

2) technical materials;

3) household materials (Tables 1 and 2).

Construction and industrial construction materials include construction ceramic products, refractory materials, and construction glass.

Wall-bop, tombop and facade ceramics, floor slabs, ceramic pipes used for sewage, ceramics resistant to chemical substances, filtering porous ceramics, expanded clay, agloporite and sanitary construction ceramics are made from construction ceramics.

Refractory materials used in the construction of industrial equipment are divided into eight types (sand-soil, aluminosilicate, magnesium chromite, zirconium, carbon, oxide and oxygen-free) depending on their chemical and mineralogical composition and production technology.

Classification of ceramic materials according to application and water absorption. Table 2

Function	Ceramic type	Raw material	Product type
A class of semi-ripened ware with a water absorption of up to 15%			
Building ceramics. Wall materials	Highly porous, large-grained	Soil, sand and other expansive materials	Clay bricks and hollow stones (blocks)
Thick materials	Highly porous, large-grained	The soil is sand	Tiles
Decoration materials	Highly porous, large-grained	Soil, fireclay, sand, feldspar, kaolin	Exterior finishing tiles and blocks, mosaic and faience tiles
Sanitary ware	Faience, semi-porcelain	Soil kaolin, bentonite, quartz, quartz sand	Equipment of sanitary units
Household and artistic decorative ceramics	Earthenware, semi-porcelain, majolica	Soil kaolin, bentonite, quartz, quartz sand, feldspar	Kitchen and tea room tableware, artistic decorative items

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Refractory ceramics	Sand-soil, aluminosilicate magnesium, chromium, zirconium, carbon, oxide, oxygen, etc.	Soil kaolin, fireclay, quartzite, calcareous dolomite, magnesite, oxides, nitrides, carbides, etc.	bricks, blocks. complex shaped items
A class of dense particulate material with a water absorption of not more than 0.5% and fully matured			
Technical ceramics	Mullite, corundum, pure oxide, electric porcelain	Soil, kaolin, clay, feldspar, etc	Insulators. Thermocouple case, designed for vacuum
Acid-resistant ceramics	Stoneware, acid-resistant porcelain	Soil, kaolin, quartz, feldspar, fireclay	cooking flasks, refractory parts for firehouses
Household and artistic decorative ceramics	Hard and soft household porcelain	Soil kaolin, quartz, feldspar	Acid-resistant containers, chemical industry tools, kitchen and tea room tableware, decorative items
Sanitary building ceramics	Porcelain fired at low temperature	Soil. kaolin, quartz, sand, feldspar	Plate, bowl, tea plate, bowl, vase and others _

The materials used in technology mainly belong to groups of technical ceramics, technical glass and technical steel.

Conclusion

In conclusion, ceramic composite materials, especially spool ceramics, have been handed down from ancestors to generations by folk masters. Currently, the technological processes of extracting and transporting raw materials, washing, grinding, making powder or briquettes, grinding, mixing, heating and baking, packaging, obtaining ceramics and refractory materials, production of artificial ceramics, the technological processes of the production of elegant ceramic products, building ceramic products, glass and steel have entered our lives rapidly. There is no field where ceramic composite materials are not used. Ceramic composite materials are widely used in aggressive environments, aggressive environments, measures against metal corrosion. The future of ceramic composite materials is bright.

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