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3,744,984

PROCESS FOR THE MANUFACTURE OF FOAMED PORCELAIN-LIKE SHAPED ARTICLES

Osamu Sato, 3351 Oaza Hoshida, Katano-cho, Kitakawachi-gun, Osaka, Japan

No Drawing. Filed Apr. 5, 1971, Ser. No. 131,507

Int. Cl. C03c 3/04

U.S. Cl. 65—22

18 Claims

ABSTRACT OF THE DISCLOSURE

A process for the manufacture of foamed porcelain-like shaped articles which comprises mixing (A) at least one aggregate component selected from the group consisting of the silicate glass powders and silicate mineral powders; (B) a water glass component; (C) an inorganic alkali salt component which generates a gas by substantially decomposing at the firing temperature; and (D) a component for adjusting the foaming temperature, said component being selected from at least one mineral powder selected from the group consisting of boric acid, borates, lead oxides and zinc white, and at least one mineral powder selected from the group consisting of the alumina compounds, magnesia compounds and calcium compounds; molding the resulting mixture; and thereafter firing and foaming the resulting shaped article at a temperature ranging between 700° and 1200° C.

This invention relates to a process for the manufacture of foamed porcelain-like shaped articles.

As a process for manufacturing a foamed shaped article having as its component a silicate glass powder, a method has been proposed in the past which comprises adding on the order of 0.5% of either a carbon powder or calcium carbonate to the silicate glass powder as a blowing agent, and also adding a small quantity of a powder such as of Al, Zn or Cu for inhibiting the foaming until the silicate glass softens, placing the so obtained mixture in a heat-resistant chromium-nickel-copper mold and then heating the mold to about 850° C. to render the silicate glass into a fluid state and cause the generation of CO₂ by the foaming of the blowing agent to thereby produce a foamed porcelain-like shape article. Another process is known wherein a blowing agent resulting from the reaction of a caustic alkali with aluminum is added to a clay slip, after which this mixture is poured into a mold of gypsum, the blowing agent is caused to foam in the mold to form minute air bubbles, which are, without defoaming, caused to solidify in the foamed state, and thereafter the foam is removed from the mold and dried, followed by firing in a furnace at an elevated temperature of above 1200° C. to produce a foamed porcelain-like shaped article which is light and possesses good heat insulation properties.

A further known process for manufacturing a foamed porcelain-like shaped article molds a clay slip to which has been added zeolite, dries the article after removing from the mold, and thereafter places the article in a furnace for heating at an elevated temperature in excess of 1200° C. to decompose the zeolite and generate a gas to effect the foaming and firing of the shaped article.

However, in these prior art processes for manufacturing foamed porcelain-like shaped articles which use the silicate glass powder as their constituent, the silicate glass flows about in the mold and adheres to the mold walls, with the consequence that a high frequency oscillator must be utilized for removing the shaped article from its mold. Again, the shaped article must be passed through a lehr for removing the strain. There is also the drawback that a glaze effect is not demonstrated even though a glaze

is applied to the surface of the shaped article before its firing, since the glaze sinks into the interior of the article as a result of the motility of the silicate glass in its mold.

In addition, even in the case of firing a clay slip to which only zeolite or a caustic alkali with aluminum is added as the blowing agent, there are drawbacks such as the required firing temperature exceeding 1200° C. and the poor surface strength of the baked-on glaze even though various colors are applied by means of glazing at the time of firing.

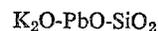
An object of the present invention resides in solving the foregoing drawbacks and providing a process for the manufacture of foamed porcelain-like shaped articles by firing a shaped article of a composition consisting of a silicate glass powder and/or a silicate mineral powder to which have been added water glass and other materials, and forming in the shaped article a porous structure consisting of minute independent cells by means of the gas that generates during the firing of the shaped article to thus provide a foamed porcelain-like shaped article of low density and of light weight, and having properties such as low water absorbency, good form after firing, excellent surface luster, superior compressive strength and flexural strength and a wide choice of color tone as applied by means of a glaze.

Another object of the invention is to provide a process wherein, in the manufacture of a foamed porcelain-like shape article by firing a shaped article of a composition consisting of a silicate glass powder and/or a silicate mineral powder to which have been added water glass and other materials, the firing and foaming can be carried out at a temperature ranging between 700° and 1200° C., and moreover the motility of the silicate glass in the mold can be checked and a foamed porcelain-like shaped article of the desired shape can be produced.

Other objects and advantages will become apparent from the following description.

The foregoing objects can be achieved by either a procedure consisting of molding a shaped article from a mixture obtained by admixing water glass with a silicate glass powder and/or a silicate mineral powder, and firing and foaming the shaped article at a temperature ranging between 700° and 1200° C., and preferably 750° to 1000° C., or a procedure consisting of firing the foregoing mixture followed by comminution of the so fired product, admixing water glass thereto, molding a shaped article therefrom, and firing same at a temperature ranging between 700° and 1200° C., and preferably 750° to 1000° C., to effect the foaming of the as yet unfoamed component.

As the silicate glass powder which can be used in the invention process, the finely ground powders obtained in customary maner by comminution of such silicate glasses as the Na₂O-CaO-SiO₂ type soda-lime glass, the



type lead glass, the Li₂O-Na₂O-K₂O-BaO-Al₂O₃-SiO₂ type barium glass, the Na₂O-B₂O₃-SiO₂ type borosilicate glass, the CaO-MgO-Al₂O₃-SiO₂ type alumina-silicate glass, the LiO₂-Al₂O₃-SiO₂ type lithia-alumina-silicate glass and the SiO₂ type quartz glass; and used are, for example, those of particle diameter 0.004 mm. to 1.00 mm. (20 mesh), and preferably 0.008 mm. to 0.50 mm. (32 mesh). Conveniently used silicate glass powders are those of soda-lime glass, barium glass and borosilicate glass.

On the other hand the silicate mineral powders which can be used in the invention process include such silicate mineral as quartz sand, silica, olivine, garnet, petalite, beryl, cordierite, pyroxene, amphibole, talc, pyrophyllite, mica, chlorite, chrysotile, antigolite, kaolin, toseki, allopheane, feldspar, aplite, zeolite, alunite, obsidianite and