1. (WO2005049518) RAW MIXTURE FOR PRODUCING FOAM GLASS AND METHODS FOR PRODUCING SAID RAW MIXTURE, BATCH AND FOAM GLASS

PCT Biblio. Data | Description | Claims | National Phase | Notices | Drawings | Documents

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Title **(EN)** RAW MIXTURE FOR PRODUCING FOAM GLASS AND METHODS FOR PRODUCING SAID RAW MIXTURE, BATCH AND FOAM GLASS
(FR) MELANGE DE MATIERES PREMIERES SERVANT A PRODUIRE DU VERRE MOUSSE ET PROCEDES DE PRODUCTION D'UN MELANGE DE MATIERES PREMIERES, D'UNE CHARGE ET DE VERRE MOUSSE

Abstract:

(EN) The invention relates to producing building materials exhibiting low heat-conduction and density values, in particular to production of a block foam glass from crushed glass. The inventive method makes it possible to obtain a high-quality foam glass in a low time- and energy-consuming manner by producing an initial raw mixture using an aqueous alkali solution of sodium and/or calcium in a quantity equal to or greater than 30-70 mass % and a powdered crushed glass of a random chemical composition in a quantity ranging from 26 to 65 mass %. The thus obtained dehydrated raw mixture is treated at a temperature of 450-550°C is broken into a powdered batch which is, afterwards heated to a foaming temperature ranging from 750 to 830°C.
(FR) La présente invention relève du domaine de la production de matériaux de construction présentant de faibles valeurs de conduction thermique et de densité et concerne en particulier la production de verre mousse en blocs à partir de déchets de verre tout-venants. Le procédé de la présente invention permet d'obtenir un verre mousse de qualité d'une manière peu coûteuse en temps et en énergie. Pour ce faire, il convient d'utiliser, pour la production du mélange de matières premières initial, une quantité d'au moins 30 à 70 % en masse d'une solution alcaline aqueuse de sodium et/ou de calcium, ainsi qu'une quantité comprise entre 26 et 65 % en masse de poudre de déchets de verre de composition chimique aléatoire. Le mélange de matières premières déshydraté ainsi obtenu est d'abord traité à une température comprise entre 450 et 550 °C, après quoi il est réduit en une charge en poudre qui est ensuite chauffée à une température de moussage comprise entre 750 et 830 °C.

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RAW MIXTURE foam glass production and

A method for producing raw mix of the charge and

Foamglass

Field of technology

The invention relates to the production of building materials with low thermal conductivity and high values of density, in particular for the production of raw mix and methods of producing the raw mix, Shih-you and foam glass block that is used as an effective heat-insulating material in a variety of building structures. The invention can be applied in the preparation of foamed glass with closed cell structure made of recycled glass breakage regardless of its chemical composition.

BACKGROUND

Among the building materials with good heat and sound insulating foam glass-governmental performance features low bulk density, low thermal conductivity and high sound absorption, it is non-flammable, heat resistant and chemically resistant material. Foam glass representation is a lightweight porous material obtained by sintering and spu-equalization at high temperatures, a mixture of powdered glass or other source of glassy materials with a blowing agent (thin-koizmelchennymi limestone, chalk, soot, coke). Found that the bulk density, thermal insulation, mechanical properties of the foam glass best performance for foam glass, the structure of which is dominated by closed pores t.e.zamknutye not communicating among themselves cavities separated by layers of the material. Having a closed pore foamed glass structure makes the product impervious to liquids including water, water vapor and gases.

Experience shows that one of the key factors that influence the process-ing on producing high-quality foamed glass is a mixture of raw materials to produce it, since the composition of the mixture depends on its physical and chemical structure, which determines its thermal and mechanical properties. Various attempts have been made in the art to improve the properties by choosing foam glass composition of the raw composition for its manufacture.

Foam glass can be produced in many ways by using compositions based on various glass and foaming agents. Glass normally used in powder form. Stekloporoshok obtained either from a specially welded glass melts (US, 4192664, cl. S03V 19/00, 1980, US, 3,403,990, Cl. 65-22, 1968), or from the battle window, container, the optical and other glasses (US, 4198224, cl. S30V 19/08, 1980). Analysis of published data shows that the widespread produc-tion of foam glass using a specially brewed and granulated glass, to improve the properties of which use expensive-ing ingredients (WO 00/61512, cl. SOZS 11/00, S03V 19/08, 2000 g, DE 2010263, SOZS 11/00, 1979).

Long time using the raw mix of the patent US, 3151966, cl. 65-226 1966 G, prepared by mixing from fine glass and the adjustable gas which contains a carbonaceous reductant ingredient of the number and oxidant sulfates, oxides and other chemical

reagents. Although the use of certain raw mix can harass pro-foamed glass of sufficiently high quality with a homogeneous struc-ture, which provides its operational stability, however, application-tion known raw material is limited by its high cost due to labor doemkosti its receipt related to the implementation of a number of additional operations, such as milling, baking, stabilization.

Traditional technology involves the production of foamed glass melt glass of special composition, grinding it with a blowing agent for the preparation of finely divided charge, foaming shaped charge in the process of annealing at a temperature of 700 ° C. The use of the well-known techno lo-energy produces foamed glass of sufficiently high quality with a homogeneous structure, ensuring its operational stability, however foam glass has a high cost due to the high labor-capacity operation obtaining the desired glass composition.

It is known that for foam glass with constant physical properties (bulk density of less than 280 kg / m, water absorption smaller than 5%, and a relatively ordered structure) technol-ogy developed in relation to the original glass strictly defined composition. That is why the choice of raw materials is of great importance. Raw materials for producing foamed glass must be suitable taking into account the cost price of its production, which pays attention to time and temperature, the foaming.

Pat US, 4198224, cl. POPs 19/08, 1980 discloses a process for preparing of foamed glass cullet comprising heating the powder blend to a foaming temperature, holding at this temperature until completion of the foaming process and the subsequent cooling. Foam glass produced by Pittsburgh Corning Corporation, was prepared from a fine powder of glass and a blowing agent. The charge for the production of foamed glass is made from glass, recyclable th (the so-called cullet). Glass strictly defined composition and gas evolution tor, which are in the solid phase, and thoroughly milled in a stirred ball mill to an average grain size of 3-10 microns. In this case, grinding components are carried out separately and in several

stages: Snatch la carry separate grinding of glass and blowing agent, and then pro-lead their joint grinding. The mixing finely dispersed components of raw mixture is carried out in the solid phase. The resulting powdered mixture was then sintered in two stages at a temperature below the foaming temperature, and then cooled. Unfortunately, the known method is complicated by the fact that it is linked with the problem of mixing of the initial components of the solid phase in a state that does not provide them a high level of homogeneity in the distribution of the volume of the mixture. Furthermore, in the grinding mills metal mixture leads to a metal contamination of balls and lining, as already indicated above, further gives The conditions of pore formation during the production of foamed glass. Unfortunately, given the sharp rise in energy prices using lime-tion powder charge and the method of its production leads to udoro-zhaniyu foam glass. This requirement imposes restrictions on the choice is subjected to foaming of the composition.

Pat RU, 2109700, cl. S03S 11/00, 1998 known technology of granulated foam glass-based glass waste by preparing a powder blend of broken glass and the adjustable gas. In WO 00/61512, cl. S03S 11/00, 2000 discloses a method for producing a granulated glass foam using waste glass with one or two-stage treatment the granulate at a temperature 200-300 ° C or 400-800 ° C for a time not exceeding 15 minutes.

Sodium silicate or waterglass so called widely known as an additive in the production of granulated foam glass, it is necessary as a binder for the granules (e.g., DE, 2010263, PT/RU2004/000415

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C03C 11/00, 1979). Patent RU, 2162825, cl. S03S 11/00, 2001, is disclosed a method of making foam glass cullet from the demolished determined sary composition, comprising the preparation of the charge by co-grinding of broken glass and carbonate blowing agent, Shih-granulation you with irrigation an aqueous solution of soluble glass, drying granules and heat-treated at foaming temperature 780-820 ° C, followed by annealing.

The closest in technical essence and the achieved results that the present invention is a method for producing foamed glass, comprising a preliminary heat treatment at a temperature below the foaming starting temperature of the mixture obtained from the cullet finely dispersed powder, a carbonaceous component and sodium silicate, heating the mixture to a foaming temperature, holding at this temperature until the completion of the process of price formation and subsequent cooling (RU, 2187473, cl. S03V 19/08, 2000). Known method to obtain high-quality chat foam glass block based on the alkali aluminosilicate glass-cate waste. In the conventional method the dispersion giruemy broken glass and foaming mixture containing silica, carbon-containing component, a metal sulfate and sodium liquid glass in the amount of 0.5-5.0 May. %. The resulting mixture was first sintered in order foamed-temperature 790-860 ° C, quenching and annealing is carried out. Foaming additive prepared by mixing the silica glass of a liquid in dry or water-wet condition, black sulfate and boric acid. The resulting mixture was subjected to granulation in the presence of molten glass to improve the collection of material in granules. For improvement in the granulation of the material mixture is moistened, if liquid glass is introduced dry powder. Fill the metal mold-tion of granulated material and fed into a furnace for sintering and annealing foaming. Obtained in a known foam glass has a high cost associated with the need for a long and rather com-plex mechanical mixing of the components to a very uniform distribution of particles in the foam glass powder. In addition, they say, in metal mills leads to contamination of the charge and the lining of metal balls, which further violates the terms of pore formation in the sintered mixture. This in turn affects the stability, the uniform and reproducible structure of closed-cell foam glass. The coefficient of uniformity of the foam glass is not high enough. The operating conditions of this method worked out for the specific composition of broken glass, which makes them unsuitable ri n the use of cullet arbitrary composition. Instability and complexity of the composition of cullet by the dependency on funktszhonal-tion destination produced technical glass, of raw ingredients, as well as its modes of cooking, and lead to instability of the qualities produced from it foamed glass.

Disclosure of invention

In the framework of this application solves the problem of expanding the resource base and the development of such technology, which would produce foam glass without regard to the chemical composition of cullet, ie of nesorti-plated glass cullet, and with low power consumption of production. There is a need to develop a method for producing a foamed glass-em use chemically different types of technical-battle window glass, container, chemical vessels and their mixtures, in varying proportions relative to each other. In addition, solved the problem of increasing the reproducibility of the structure of the foam glass with a homogeneous fine-pored structure containing pores closed form.

This object is achieved by the fact that the raw material mixture for the production of foamed glass is dehydrated composition as the result of physical and chemical interactions at 450-550 ° C of an aqueous alkaline solution of sodium silicate and / or potassium hydroxide and powdered different reactive towards it supplements containing unsorted broken glass and carbon blowing.

The object is also achieved in that the method of preparing raw material mixture for the production of glass foam comprises mixing at a temperature above 70 ° C aqueous alkali silicate solution of sodium and / or potassium in an amount of 30-70 May. % Chemically active with respect to the by sodium and potassium silicate powder additive containing unsorted ing cullet and blowing carbon, heat treating the resulting dispersion with stirring viscous-flow at a temperature range of 450-550 ° C for a time sufficient to remove water therefrom, including chemically bound.

It is advisable to choose the ingredients while stirring from the relationship, May. %: An aqueous alkaline solution of sodium silicate and / or potassium in an amount of 30-70 powder in an amount of unsorted cullet 25-65, carbon blowing agent in an amount of 4-9.

Furthermore, the use of aqueous alkali is preferably of a solution of sodium and / or potassium density 1.3-1.5 kg / m with the value of the silicate modulus, 2-3.5.

The problem is solved in that the method for the preparation of foamed glass batch comprises mixing at a temperature above 70 ° C an aqueous alkaline solution of sodium silicate and / or potassium in amounts of 30-70 wt.% And reactive towards the sodium silicate and powdered potassium supplements containing unsorted cullet and blowing carbon, obtained by heat treating the dispersion with stirring viscous-flow temperature 450-550 ° C to obtain a dehydrated composition, then cooling decon-vozhennoy composition and milling it into powder. For production of batch ingredients under stirring selected from the relation of the masses. %: An aqueous alkaline solution of sodium silicate and / or potassium 30-70, 25-65 cullet ungraded powder, carbonaceous blowing 4-9.

Preferably, the dehydrated milled composition in powder with a grain size not more than 15-20 microns.

The task is also solved in that the method for producing foamed glass comprises mixing at a temperature above 70 ° C an aqueous alkaline solution of sodium silicate and / or potassium in an amount of 30-70 m: Al. % Reactive powders and towards the sodium silicate and potassium

supplements containing unsorted cullet and blowing carbonaceous, heat treating the resulting dispersion with stirring viscous-flow at a temperature of 450-550 ° C to produce dehydrated zhennoy composition subsequent grinding the cooled composition powder, heating the powder to a foaming temperature range of 750-830 ° C and holding at this temperature until completion penoob education, followed by cooling.

It is suitable for the production of foamed glass ingredients under stirring to choose from the ratio by weight.%: Alkaline aqueous solution of sodium silicate and / or potassium 30 - 70, the powder unsorted glass-battle 25 - 65, carbon-blowing 4 - 9.

As ungraded cullet, ie Artificial technical-cal glass, are systems comprising different oxides, the process of interaction of an aqueous solution of alkali metal and unexploded the selected cullet demanded his study of the thermodynamic regimes. These optimum ratios of ingredients and temperature regimes were established by the authors on the basis of experimental study of the thermodynamic laws of the process of synthesis of the initial mixture on the basis of an aqueous solution of an alkali metal and a stack of unsorted Lobo, ie cullet arbitrary chemical composition. Dissolved in water to a certain concentration of the sodium silicate and / or potassium represents an alkaline solution that is needed for the occurrence of physicochemical processes which accompany its interaction with the oxides of cullet, regardless of their composition, including glass content of alkali oxides.

The essence of the invention consists in establishing a causal link between the physical and chemical properties of the foam glass, thermodynamic regimes raw meal production, including a composition of raw ingredients and the temperature of its receipt, a sequence of mixing the ingredients and modes of its heat treatment. In the absence of well-known patterns of physical and chemical state of the material after it is processed at a foaming temperature and the initial composition of the preparation of raw mix, the authors experimentally be-whether they found the optimal values of the aqueous alkaline content of a solution of sodium silicate and potassium, powder, broken glass and carbon-CGS , after which allows sequential mixing and subsequent treatment at a temperature range of 450-550 ° C, to obtain the required parameters of foamed glass. The most suitable module silicate aqueous alkali metal silicate solution amounts to the solution at a density of 2-3.5 1.3-1.5 kg / m.

This method of producing foam glass mixing an alkali metal silicate glass powder technical arbitrary chemical composition and carbon-foaming agent is not performed in the solid state and in aqueous solution of alkali metal silicate, which is a viscous-flow liquid hydrogen exponent medium pH> 7, and non- such component, which ensure a uniform distribution of a powdery additive by volume of the charge and the required flow of physico-chemical processes, with stirring, followed by heating to a temperature of 450-550 ° C, bound, including mixtures and dehydration removal of chemically-bound water connected. Mixing of the starting components of the mixture in a state of liquid phase without pre-heating at a temperature of 70 ° C allows to obtain a uniform in the future in terms of penostek la structure of homogeneous, closed gas-filled pores at a low power consumption of production without regard to the chemical composition of technical glass.

The following specific non-limiting example is presented to illustrate the invention.

Example.

The initial mixture is prepared from the following components. As part of the initial use of 150 kg of commercially available, ie the commercially available aqueous alkaline solution of sodium silicate and potassium (the optimal ratio of 1: 1) made at the Ryazan-for water (water glass can also be obtained from tripoli bezavtoklavnogo autoclave or by hydrothermal leaching of oxide of silica in an alkaline environment (pH indicator of the medium > 7) at a temperature of 90-100 ° C). An aqueous solution of sodium silicate and potassium (the optimal ratio of 1: 1) at ambient temperature, stirred in those first-chenie 10-15 minutes from fine powder unsorted, inequality zobrannogo cullet different brands and chemical composition, taken in an amount of 65 kg. This cullet is made from combat window, container FOR ANY color and glassware in arbitrary proportions relative to each other. Then, during stirring the viscous-flow composition it is added 20 kg carbonaceous holding gasifier. In the process of mixing the composition and the binding free

water and alkali, water soluble negatively affecting the spine of the final product - glass foam. The resulting mixture has a gray color. After mixing all components of the feed mixture conduct its heat treatment at 530 ° C for 65 minutes okodo. During the heat treatment, a further physical and chemical processes that are accompanied by the removal of free hydration and chemically bound water and the increase in the viscosity of the mixture, after which it becomes dark gray. Weight cooled to ambient temperature, feed mixture amounts to about 60% by weight of the starting components. Then, the grinding of the mixture to no more than the grain size of 15-20 microns. Crushed raw material mixture is poured into metal molds, processed by special-ended, and heat-treated at a temperature of 780-830 ° C foaming at least 90 minutes.

Table 1 shows the results of comparative tests of foamed glass produced by this technology, compared with the foam glass "FOAMGLAS" ^{R} manufactured by Pittsburgh Corning Europe (of Belgium), the density of comparable brands.

Table 1

Наименование показателей	Результаты испытаний данного пеностекла	Результаты испытаний пеностекла "FOAMGLAS"^{R}
Кажущаяся плотность, кг/м^3	218-188	253-226
Коэффициент теплопроводности, Вт/м К	0,062-0,065	0,072-0,082
Коэффициент теплоемкости, кДж/кг К	0,80-0,81	0,84-0,89
Гигроскопичность, мас. %	0,3-0,5	0,3-0,2
Потеря массы после кипячения в воде в течение 3 часов,%	0	0
Водопоглощение, %	1,2-1,00	0,7-0,68
Прочность при сжатии при 10 % линейной деформации, кг/см^2	1,61-2,7 (16,1-27)	1,83-2,23 (18,3-22,3)

Горючесть	не горит	не горит

Comparative analysis of one of the results of the test pe-nostekla and foam glass FOAMGLAS ^{R} shows considerable overlap in properties between them.

INDUSTRIAL APPLICABILITY

The invention may be used in the preparation of foamed glass with reproducible fine pore structure of cullet arbitrary chemical composition. The invention provides the use of an alkali aqueous solution of sodium silicate and / or potassium and reactive additives thereto, one of which is a powder cullet arbitrary chemical composition allows to obtain after stirring and blowing the carbon-containing heat-treatment at a temperature of 450 -550 ° C dehydrated composition suitable for producing foamed glass with high thermal performance, but with low energy intensity of production by eliminating special cooking on the chemical composition of glass at high temperatures.