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(54) Title: PROCESS FOR MAKING AERATED CONCRETE

(57) Abstract

Process for making aerated concrete whereby the aggregates consisting of sand, fibersand other materials, are previously treated by being mixed with the dispersion obtained by adding surface-active agents and reactive metal powder in a basic environment to an aqueous solution of a hydro-soluble cellulose derivate, and by drying hot while mixing to obtain, by placing the aggregates thus treated into the mixer together with the cement or other binder and water, formation of macrovoids distributed with maximum uniformity.

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Title

"PROCESS FOR MAKING AERATED CONCRETE"

Present state of the art

It is known that absorption of air by concrete, and its expansion by formation of macrovoids, provides considerable advantages such as greater lightness, increased resistance to frost, better heat insulation and protection from noise, dehumidification of brickwork helped by aerated plastering, lower retention of humidity in new buildings.

It is also known that the percentage of air to absorb will vary according to the purposes to be fulfilled.

Distribution of the macrovoids throughout the concrete must however be as uniform and regular as possible so that the benefits brought by their function shall be equally effective at all points.

Various additives are used to form macrovoids, such as: resinous acids and their salts, fatty acids and their salts, alkyl-aryl sulphonates, alkyl sulphates, phenol-ethoxylates, ionic and non-ionic surface-active agents generally; reducing metal powders able to develop gaseous hydrogen in basic aqueous environments (aluminum in most cases).

Use is made of different processes. During mixing, the following are put into the mixer:

a) surface-active or reactive additives, or both,

b) mixtures in powder form consisting of aggregates and additives,

c) an aqueous dispersion, in foamy form, of surface-active and reactive substances.

It is clear however that these processes will not alone ensure perfectly uniform dispersion of the additives throughout the whole mixture and consequently uniform distribution of the macrovoids.

If additives are put into the mixer singly, quantities are in fact usually limited so that they can be uniformly distributed.

Further, reaction times are negative in their effects partly because these reactions tend to develop in the mixer itself while it is intended that they should mainly occur when the concrete is in place so that the resulting microvoids form when the concrete will be no longer disturbed.

When mixtures of aggregates and powdered additives are used the differing specific gravities of the component materials tend to impede achievement of uniformity from the time when preparation of the mixture begins.

In the same way the problem of uniform distribution of the macrovoids cannot be solved by prior transformation of a dispersion of additives in foam because the foam itself is insubstantial.

If, according to the purpose for which the concrete is made, differing degrees of aereation (and different sizes of macro voids) are required, the systems considered do not facilitate the making up of various proportions, even if always limited and therefore difficult to measure or weigh out.

Where mixtures contain various types of additives problems arise of homogenizing and stabilizing it if it is fluid.

If the mixture consists of powders, the larger particles of materials will inevitably sift down to the bottom in time.

This present invention eliminates or lessens the above drawbacks and, further, offers considerable advantages as will be explained below.

Description of the invention

Subject of the invention is a process for making aerated concrete in accordance with which a solution of a hydro - soluble cellulose derivate is prepared in water and to this is added a surface-active agent and a metal powder reactive in a basic environment.

The dispersion so obtained is mixed into, and evenly absorbed by inert materials such as sand, fibers or whatever else is to be mixed with the cement or other binders and the water.

A drying process is then carried out by mixing under heat so as to achieve actual modification of the above aggregates by absorption or piling together.

The aggregates thus treated are put into the cement mixer together with the cement or other binding material and the whole is mixed dry for as long as necessary for a perfectly uniform distribution of the ingredients, water being added during the movement and mixing done for the length of time needed for them all to be completely wetted.

Production of gas, during mixing, generated by the reactive powder will cause formation of air bubbles, practically grain by grain or fiber by fiber, absorbed by the mass of material and therefore of macrovoids distributed with maximum uniformity.

The liquid or pasty surface-active foaming agents that assist distribution and stabilization of the reactive powder on the grains of sand or on the fibers and contribute to formation of the macrovoids, are ionic, non-ionic or both associated together.

In one type of execution the reactive powder is aluminum which, in the presence of water and in a basic environment, develops hydrogen, the hydro-soluble cellulose derivate

is carboxymethylcellulose while the surface-active agent is a sulphonate.

The quantity of cellulose derivate that ensures mechanical stability of the metal to abrasion and plasticity of the mixture, is in relation to the surface area of the aggregates while the type of said substance is in relation to the speed of formation of the desired dispersion.

By making a suitable selection of the various additives, such as reactive powder, cellulose derivate, surface active agent, and others, mixtures can be prepared already complete with cement or with any other binders or plasticizers, so that only water need be added to the material in the cement mixer.

By a suitable choice of the above elements, waterproofing properties, in addition to the macrovoids, can also be given to the concrete.

By making a suitable choice of the various elements, the process can be applied using any type of cement, lime or binder generally speaking.

If the treatment can be carried out rapidly by using a suitable type of machine, basic types of aggregates and surface-active agents can be employed to stop oxidation of the metal powders which cannot proceed in the absence of water.

Advantages

Additive proportions can be established very easily and with great accuracy.

The additives are evenly distributed throughout the cement with consequently uniform distribution of macrovoids.

Difficulties caused by varyious specific weights of the components and their different behaviours, can also be

overcome.

As results are constantly the same, practically identical reproduction of the characteristics becomes possible in all varieties of composition.

During transport, in the pre-mixing stage of dry cement and aggregates for preparation of the mixture, the cellulose derivate protects the treated aggregates from phenomena of abrasion.

By means of the process described, it is especially possible to obtain optimum formation of:

- castings of concrete or reinforced concrete,
- de-humidifying, noise-deadening, heat-insulating cement plastering protected against the effects of frost.

As the applications of the invention have been described as examples only not limited to these, it is understood that every equivalent application of the inventive concepts explained, and every product executed and/or operating in accordance with the characteristics of the invention, will be covered by its field of protection.

Claims

1. Process for making aerated concrete characterized in that the aggregates consisting of sand, fibers and other materials, are previously treated by being mixed with the dispersion obtained by adding surface-active agents and reactive metal powder in a basic environment to an aqueous solution of a hydro-soluble cellulose derivate, and by drying hot while mixing, so as to obtain, by absorption or by aggregation, actual modification of said aggregates, and, when the aggregates so treated are put into the mixer together with the cement or other binder and the water, to secure, when mixing takes place to develop the gas generated by the reactive powder, practically grain by grain or fiber by fiber, the formation of macrovoids distributed with maximum uniformity.

2. Process for making aerated concrete as in claim 1, characterized in that, after putting the treated aggregates together with the cement or other binder into the mixer, dry pre-mixing is done for as long as necessary to obtain optimum uniformity of distribution after which water is added while mixing proceeds for as long as needed to wet all the ingredients thoroughly.

3. Process for making aerated concrete as in claim 1, characterized in that the cellulose derivate is chosen according to the speed at which the dispersion is to be made.

4. Process for making aerated concrete as in claim 1, characterized in that the quantity of cellulose derivate is calculated according to the surface area of the aggregates.

5. Process for making aerated concrete as in claim 1, characterized in that the hydro-soluble cellulose derivate is carboxymethylcellulose.

6. Process for making aerated concrete as in claim 1, characterized in that the surface-active agent is a sulphonate.

7. Process for making aerated concrete as in claim 1, characterized in that the reactive powder is aluminum.

8. Process for making aerated concrete as in claim 1, characterized in that mixing of the aqueous dispersion with the aggregates is forced.

9. Process for making aerated concrete as in claim 1, characterized in that mixtures are prepared of treated aggregates, complete with cement or other binders or plasticizers, so that water only has to be added in the mixer.

AMENDED CLAIMS

[received by the International Bureau on 14 July 1986 (14.07.86);
original claims 1,2 and 9 amended; other claims unchanged
(2 pages)]

1. Process for making aerated concrete characterized in that the aggregates consisting of sand, fibers and other materials, are previously treated by being mixed with the dispersion obtained by adding surface-active agents and reactive metal powder in a basic environment to an aqueous solution of a hydro-soluble cellulose derivate and by drying said dispersion when hot so as to obtain, when the cement, or other binder, is mixed with the water, and by development of gas generated by the reactive fiber, formation in the concrete of microvoids of maximum uniformity practically on each grain or fiber.

2. Process for making aerated concrete as in claim 1, characterized in that the treated aggregates are given a preliminary dry mixing with the cement, or other binder, before water is added.

3. Process for making aerated concrete as in claim 1, characterized in that the cellulose derivate is chosen according to the speed at which dispersion is to be made.

4. Process for making aerated concrete as in claim 1, characterized in that the quantity of cellulose derivate is calculated according to the surface area of the aggregates.

5. Process for making aerated concrete as in claim 1, characterized in that the hydro-cellulose derivate is carb.-oxymethylcellulose.

6. Process for making aerated concrete as in claim 1, characterized in that the surface-active agent is a sulphonate.

7. Process for making aerated concrete as in claim 1, characterized in that the reactive powder is aluminum.

8. Process for making aerated concrete as in claim 1, characterized in that mixing of the aqueous dispersion with the aggregates is forced.

9. Process for making aerated concrete as in claim 1, characterized in that packages are prepared of treated aggregates mixed with cement,or other binder, and with plastici-

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zers if desired, or with other additives, so that only water has to be added to form the mixture.

INTERNATIONAL SEARCH REPORT

International Application No PCT/IT 86/00010

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [8]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: C 04 B 38/00, 28/02 //(C 04 B 28/02, 22:04, 24:16, 24:38)

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	C 04 B 28/00 C 04 B 38/00 C 04 B 40/00

Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
Y	NL, C, 27473 (R. HANDL) 15 February 1932, see claim and lines 9-14	1,5-7
Y	US, A, 4058405 (J.T. SNYDER et al.) 15 November 1977, see claim 1; column 2, lines 12-19	1,5-7
A	FR, A, 2225391 (INTERNATIONAL COATING PRODUCTS) 8 November 1974, see claims 1,2,4,5,8	1,2,9
A	US, A, 3236925 (CH.W. BRABAZON) 22 February 1966, see claim 1	

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* Special categories of cited documents: [10]

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"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24th April 1986	29 MAI 1986
International Searching Authority	Signature of Authorized Officer
EUROPEAN PATENT OFFICE	M. VAN MOL

Form PCT/ISA/210 (second sheet) - January 1985

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON

INTERNATIONAL APPLICATION NO. PCT/IT 86/00010 (SA 12110)

This Annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 20/05/86

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
NL-C- 27473		None	
US-A- 4058405	15/11/77	JP-A- 53034822	31/03/78
		CA-A- 1089499	11/11/80
		GB-A- 1587425	01/04/81
FR-A- 2225391	08/11/74	NL-A- 7404927	14/10/74
		BE-A- 813538	31/07/74
		AU-A- 6729174	02/10/75
US-A- 3236925		None	