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CORE MAKING PROCESS

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The manufacture of molds and more particularly foundry cores, presents, among others, a double problem to be solved; on the one hand, the masses used for this manufacture must have sufficient cohesion to lend themselves to molding; on the other hand, it is necessary that they be sufficiently porous to allow, when the molten metal is poured, the escape of gases generated by the molten metal and by the binders utilized in the core. This double problem offers greater difficulties in so far as foundry cores are concerned because of the position these are to occupy in the midst of the metal.

Silico-argillaceous sands ordinarily utilized as foundry sands possess by themselves an agglomerating capacity which would allow their utilization for the fabrication of foundry cores, without the aid of any binder. But experience has shown that cores thus constituted present insufficient porosity. It is consequently customary to add to the foundry sand, for this fabrication, a consequential quantity of silica the purpose of which is to increase the porosity and which may attain from 70 to 85% of the mixture. The addition of such a high proportion of silica necessitates, for the agglomerating process, the intervention of binders, usually constituted by organic substances such as molasses, the residual lyes of sulphited cellulose, and to which it is generally necessary to add a considerable proportion of linseed oil, which by oxidation gives the agglomerate the desired consistency.

The main object of the present invention is a process of making foundry cores which particularly does away with the necessity of having recourse to linseed oil or to other organic binders, while ensuring nevertheless a suitable cohesion and porosity of the cores. The invention also concerns the extension of this process to the manufacture of foundry molds properly speaking, and it comprises, as new industrial products, molds and cores fabricated by this process. The process of manufacturing cores according to the invention, consists essentially in constituting a mixture of foundry sand, binder or agglomerating agent and wetting emulsifying agent, it being possible for the foundry sand itself to contain the binder, after which the cores are formed by passage through a draw plate or by molding or pouring into molds or core boxes, according to the greater or lesser degree of fluidity of the paste obtained.

Thanks to the wetting-emulsifying agent incorporated to the sand, the latter is perfectly wet and the occluded air remains in the interior of the mass, thus producing multiple pores. It is possible to use to this effect one of the many products known in industry for their wetting and emulsifying properties, such as for instance: Isopropyl (or butyl), naphthalene sulphonate of soda (known commercially as "Brecolane") or also the products known commercially under the denomination of "Diastersols NDS," sulphonated lauric alcohols or derivatives of formaline condensed with sulphonated naphthalenes or even natural products.

The process, which is the object of the invention may be applied, particularly, to the constitution of foundry cores using initially ordinary silico-argillaceous foundry sands. In this case, the very sand containing its binder, which is the clay, is sufficient to impart to it the desired porosity by wetting it with a solution, or aqueous suspension, of the wetting-emulsifying agent, known as "Brecolane." It is possible for example, to add to the sand an aqueous solution, saturated at 10%, of this wetting agent, in a proportion of 10 to 15% of this solution with respect to the weight of the sand. After the mixture has been through a mixer, a paste is obtained which may be put through a draw plate or which may be used to fill more or less complicated core molds. The cylinders or cores thus formed are dried in a drying-room at a temperature of at least 120° C. Argillaceous cores are at last obtained having a good resistance for the use for which they are to serve and the apparent density of which may vary from 1.20 to 1.75.

According to the invention, the process may also be applied to the fabrication of cores by using initially sands which do not have by themselves practically any agglomerating capacity, such as sands constituted by more or less pure silica. In this case, in addition to the wetting agent, it is advisable to add a binder to the silicious sand. To this end, it is possible to have recourse, in particular, to sodium silicate in which case care must be taken to incorporate in the mixture a substance capable of decomposing the sodium silicate thereby giving rise to the formation of nascent silica having the power to ensure the setting of the mixture. The proportion of binder incorporated in the mixture may vary according to the degree of plasticity or liquefaction desired. If, for instance, a solution at 36° Bé. of commercial sodium silicate is used, this proportion may vary from 5 to 20% by weight of the mixture composed of the other materials.

The reaction of decomposition of the sodium silicate may be, notably, as it is known "per se," a catalytic reaction, in which case the substance which is added to the mixture to obtain this decomposition plays the unique or principal part of a catalyser. To that purpose, it is possible to use such substances as, for instance, fluosilicates, fluotitanates, fluotungstates, fluozirconates of sodium or of potassium. The quantity of catalyser for setting may vary with the setting speed desired: in general, a proportion of sodium fluosili-

cate of 2 to 15% with respect to the weight of the sodium silicate used will be employed, thus obtaining a setting time varying from 40 to 60 minutes. To allow the use of the smallest possible quantity of catalyser, it seems desirable that the ratio SiO_2/Na_2O of the sodium silicate be at least equal to 3.2. However, it is preferable that the ratio do not exceed the value of 3.35 so as not to hinder the reaction giving rise to the formation of nascent silica.

A real stoichiometric reaction may also be used by causing the flocculation of nascent silica by any reacting agent having a pH lower than that of the sodium silicate solution or containing or capable of liberating a molecule of free acid the acidity of which is at least equal to that of the silica. Along the same line of thought, it is possible to use, in order to obtain this reaction, bicarbonates which, in the presence of water, give rise to free carbonic acid, or again, a sulphate, such as for instance, aluminium sulphate which, in hydrolysing, produces sulphuric acid. It is also possible to use a sulphide capable of liberating, by hydrolysis, hydrogen sulphide which then acts as a weak acid, or an organic compound such as ortho or paratoluene sulphochloride which produces, by hydrolysis, one or several acids. Tests already effected seem to have revealed that, in the case of a reaction of stoichiometric decomposition, the ratio SiO_2/Na_2O of the sodium silicate may be lowered to about 2.5.

The quantity of wetting agent may vary with the greater or lesser degree of porosity which it is desired to obtain for the final agglomerate; if, for instance, the wetting agent known as "Diastersols NDS" or the one known as "Brécolane" be utilized, the proportion of this substance used may be chosen between 2 and 5% with respect to the weight of the sodium silicate.

It is preferable, in practical applications of the invention, to effect a thorough mixture of the catalyser or substance for setting and of the wetting agent with an equal weight of sand, and then, to add the rest of the sand. After mixing in a mixer and addition of sodium silicate a sand is obtained suitable for the fabrication of cores, either by the usual method, or by vibrating for a short time. If the proportion of sodium silicate solution is sufficiently high, the mass obtained is sufficiently fluid to be poured, notably in formed molds, which allows the construction of even very complex cores, the setting taking place due to the catalysing action of the incorporated fluosilicate. Cores thus obtained have a good resistance and are very porous, their apparent density varying, for instance, from 1.20 to 1.60.

When it is desired to constitute cores which must have special qualities of mechanical resistance and at the same time a brittleness after molding sufficiently great to permit an easy removing of the sand—for example in the case of very long and very thin cores which cannot be upheld along their length, such as those used in the manufacture of heating radiators—it is possible, in accordance with the present invention, at the same time as a certain quantity of sodium silicate is incorporated in order to ensure that the agglomerate will have the desired resistance, to add to the mixture a substance which, while not possessing any property appreciably harmful to the agglomeration, or even possessing by itself a certain agglomerating power, can be destroyed by the heat generated when the molten metal is poured. Substances which are especially suitable for this purpose are the polyalcohols and notably glycols and glycerine. As substitutes for such substances, it is also possible to use sawdust, hulls of rice or other cereals, etc. The addition of substances of this nature to the mixture to be agglomerated may also prove advantageous in those cases where, without specifically seeking to obtain a high resistance of the cores, it is profitable because of the shape of the latter, to seek a greater facility for removing the sand after molding.

As has already been said, the process, according to the invention, may also be applied to the construction of molds, this application being obtained under the same conditions as those in the fabrication of cores. In particular, in the case where the mass to be molded is constituted by a mixture of sand, of sodium silicate, of fluosilicate and of wetting-emulsifying agents, it is possible to form the molds by usual methods, by vibrating or by pouring this mixture on to the pattern, which allows the omission of a great number of delicate operations usually necessary in the molding of foundry parts: in particular an economy of specialized labor and of time is obtained and the operations of drying and of baking are eliminated.

Moreover, it is interesting to note that, as a result of the absence of organic binders, the gaseous emanation proceeding from the core and the mold is practically eliminated, which condition offers a notable improvement from the point of view of handling (facility, cleanliness, shop hygiene).

In order to diminish the risk of eventual sticking of the mass to be molded (cores or molds) to the patterns or to the core boxes, it is advisable to apply on to these patterns or boxes a rubber paint such as, for instance, that found on the market.

Hereunder are examples of carrying out the invention which are given by way of illustration.

Example 1

To 200 parts of argillaceous foundry sand are added 25 parts of an aqueous solution saturated with the wetting agent "Brecolane" (10%). A thorough mixing is effected in an emulsifying machine. The mixture is molded and dried at 120° C. by gradually raising the temperature.

Example 2

	Parts
Siliceous foundry sand	1
Sodium fluosilicate	1
The wetting agent "Diastersol NDS"	1

are thoroughly mixed.

The mixture is added to 200 parts of siliceous foundry sand.

When about to be used, 20 parts of sodium silicate are thoroughly incorporated. The mixture is molded, and the setting allowed to take place.

Example 3

	Parts
Siliceous foundry sand	1
Sodium fluozirconate	1
Saponin	1

are thoroughly mixed.

This mixture is added to 200 parts of siliceous foundry sand.

When about to be used, 20 parts of sodium silicate are thoroughly incorporated. The mixture is molded, and the setting allowed to take place.

Example 4

100 parts by weight of siliceous foundry sand are thoroughly mixed with 0.36 part by weight of sodium fluosilicate, 0.12 part by weight of the dispersing and wetting agent "Brecolane" and 0.12 part by weight of bentonite or colloidal clay. Then 6 parts by weight of sodium silicate at 36° Bé. were added to this mixture, after which the cores were molded under the usual conditions and allowed to set.

Example 5

	Parts by weight
Siliceous foundry sand	100
Barium sulphide at 80%	0.25
"Diastersol NDS"	0.12

are thoroughly mixed. Then 6 parts by weight of sodium silicate at 36° Bé. are added to this mixture, after which the cores are molded. The setting takes about three times as long as if sodium fluosilicate were used as catalyser.

Example 6

	Parts by weight
Siliceous sand	100
Paratoluene sulphochloride	0.03
"Diastersol NDS"	0.12

are thoroughly mixed; then 6 parts by weight of sodium silicate are added to this mixture and the cores are molded in the usual fashion. The setting takes place at substantially the same speed as if 0.36 part by weight of sodium fluosilicate were used as catalyser. In an immediate setting is desired, it is advisable to use a proportion of paratoluene-sulphochloride from four to five times as great as that indicated hereabove.

I claim:

1. The process of making material for foundry cores which comprises mixing foundry sand with an aqueous solution of a wetting agent and a substance which decomposes sodium silicate and thereafter incorporating in the mixture from six to ten percent of sodium silicate.

2. The process of making material for foundry cores which comprises mixing foundry sand with an aqueous solution of a wetting agent and a substance selected from the group consisting of the fluosilicates, fluotitanates, fluozirconates and fluotungstates of sodium and potassium and thereafter incorporating in the mixture from six to ten percent of sodium silicate.

3. The process of making foundry cores which comprises mixing foundry sand with an aqueous solution of the sodium sulphonate of isopropyl naphthalene and a substance selected from the group consisting of the fluosilicates, fluotitanates, fluozirconates and fluotungstates of sodium and potassium and thereafter incorporating in the mixture from six to ten percent of sodium silicate and shaping and drying the cores made thereof.

4. The process of making foundry cores which comprises mixing foundry sand with an aqueous solution of para-toluene-sulphochloride and a substance selected from the group consisting of the fluosilicates, fluotitanates, fluozirconates and fluotungstates of sodium and potassium and thereafter incorporating in the mixture from six to ten percent of sodium silicate and shaping and drying the cores made thereof.

5. The process of making foundry cores which comprises mixing foundry sand with an aqueous solution of a wetting agent and a substance which decomposes sodium silicate and with a heat-destructible substance, thereafter incorporating in the mixture from six to ten percent of sodium silicate and shaping the cores from the mixture.

6. The process of making foundry cores which comprises mixing foundry sand with an aqueous solution of a wetting agent and a substance which decomposes sodium silicate and with a heat-destructible substance selected from the group consisting of sawdust and cereal hulls, thereafter incorporating in the mixture from six to ten percent of sodium silicate and shaping and drying the cores from the mixture.

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