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PROCESS FOR MAKING SAND CORES

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This invention relates to a process for producing a core composed principally of sand, the core being for use in casting operations.

In the making of sand cores, as heretofore proposed, the sand is bonded together into a unitary mass by means of a binder, such as petroleum oil, pitch, clays, and like substances. The cores resulting from such bonding have surfaces which are not sturdy enough to withstand handling or the force of the molten metal in casting. The sand for making cores or molds has also been bonded together by means of binders, such as resins, drying oils, cements, and the like. The cores or molds resulting from the use of the last-mentioned binders have greater strength than those produced from the first-mentioned binders, but they have to be dried or baked in order to set or develop strength. Urea formaldehyde and phenol formaldehyde resins have been used to bond sands for making sand cores or molds, but these resins are not easy to incorporate with the sand, because they are deficient in sand wettability and flow, and require heating to set or cure the resins before the core or mold may be used in casting molten metal.

It has been found that sand cores can be produced which have the inherent properties of excellent sand wettability and storage stability extending over indefinite periods by employing a binder in the form of a liquid resin and obtained by reacting urea, formaldehyde, and furfuryl alcohol together as the bonding medium for the sand employed in the formation of the sand core or mold. It has been further found that by the addition of a setting agent or accelerator the set of the resin or binder can be controlled to a given time schedule at normal room temperature, obviating baking or heat curing.

Accordingly, an object of the present invention is to provide a process for producing a core composed substantially of sand which possesses the property of excellent wettability and retains its stability for long periods of storage.

Another object of the present invention is to provide a process for producing a core composed principally of sand which is especially adapted for foundry practice and which requires no baking or heat curing.

A further object of the present invention is to provide a process for producing a core composed principally of sand which is simple in execution, and commercially feasible.

Briefly stated, the process of the present invention comprises incorporating with sand in quantity sufficient to form a core an acidic accelerator and a liquid binder in the form of a resin and obtained by reacting together urea, formaldehyde, and furfuryl alcohol.

The acidic accelerator employed may be selected from the group consisting of phosphoric acid of 75% to 85% strength, sulfuric acid, hydrochloric acid, ammonium phosphate, carbamide phosphoric acid, hemi-sodium phosphate, borophosphoric acid, ammonium chloride, sodium bisulfate. An acidic accelerator made by dissolving 3 parts by weight of sodium bisulfate in 7 parts by weight of glycolic acid has been used successfully.

The urea, formaldehyde, and furfuryl alcohol are reacted together in the mole ratio of 1–2 to 1–2 to 1–4. Also, this reaction is carried out in the presence of a condensing agent, such as diethylene triamine, but it is to be understood that any other amine, alkalimetal hydroxide, ammonium hydroxide, or calcium hydroxide may be used.

The acidic accelerator may be admixed with resin obtained by reacting urea, formaldehyde and furfuryl alcohol together or the sand may be impregnated with the acidic accelerator followed by incorporation of the aforesaid resin with the impregnated sand. The latter procedure is the preferred one.

The following examples are given by way of illustration for carrying out the present invention:

Example 1

60 parts by weight of formaldehyde, 60 parts by weight of urea, 65 parts by weight of furfuryl alcohol and 0.3 part by weight of diethylene triamine are heated under agitation to 150° F., and held at this temperature for 3 hours. The temperature is raised to 210° F. and distillation allowed to take place under a slight vacuum. 110 parts of water are distilled out, condensed and removed from the system. The resultant material constitutes the binder in the form of a resin.

The designated parts of formaldehyde are based upon the use of 37% commercial grade formalin, methanol inhibited.

This binder is used to make a mold cavity by the following procedure: To 1000 parts of foundry sand are added 7 parts of an activator made by dissolving 3 parts of sodium bisulfate in 7 parts of glycolic acid, 70% technical grade. The mixture of sand and activator is mulled for 2 minutes in a slow speed muller. 20 parts of the binder is added and mulling continued for 3 minutes longer. The mixture is then removed from the muller, packed around a pattern and allowed to cure at room temperature. In about 25 minutes the pattern is removed from the sand without deformation of the mold. After standing for an additional 2 hours the mold is ready for use and molten metal is poured into the cavity. A sound casting is obtained.

Example 2

30 parts by weight of formaldehyde, 60 parts by weight of urea, 65 parts by weight of furfuryl alcohol and 0.3 parts by weight of diethylene triamine are used and the same manufacturing procedure as set forth in Example 1 is followed for the making of the binder. 55 parts of water are distilled out, condensed, and removed from the system. The binder thus made is used to make a mold cavity by the same procedure as set forth in Example 1, with good results.

Example 3

The binder is made with 120 parts by weight of formaldehyde, 60 parts by weight of urea, 65 parts by weight of furfuryl alcohol and 0.3 part by weight of diethylene triamine. The same manufacturing procedure is followed as in Example 1 and 220 parts by weight of water are removed from the system as above set forth. The binder thus made is used as set forth in Example 1 with good results.

Example 4

60 parts by weight of formaldehyde, 60 parts by weight of urea, 30 parts by weight of furfuryl alcohol and 0.3 part by weight of diethylene triamine are used to make a binder. The same procedure is followed as in Example 1, both as to manufacture and use to make a sound casting.

Example 5

The same ingredients are used and the same procedure is followed as set forth in Example 1 in the manufacture of my binder except that to the material as constituted after the removal of the water, I add 55 parts by weight of furfuryl alcohol. The binder thus produced is then

used to prepare a mold in accordance with the procedure set forth in Example 1.

Example 6

Using the same ingredients and following the same manufacturing procedure as set forth in Example 1, after the removal of water, an additional 175 parts by weight of furfuryl alcohol are added. The material is then used to make a mold in accordance with the procedure set forth in Example 1 with good results.

With the binders made in the preceding six examples the use procedure as outlined in Example 1 may be varied. The activator may be reduced to as little as 3 parts by weight per 1000 parts by weight of sand. By reducing the ratio of activator the setting time may be prolonged to, say, 4 hours and the mold thus formed is ready for molten metal in about 24 hours. Conversely, if, in Example 1, the activator is increased to 10 parts by weight, the time is approximately halved.

In producing the binder or resin a viscosity of about 1 poise is preferred, but it is to be understood that a greater viscosity can be tolerated. If the resin is of a relatively high viscosity the period of time for mulling the binder or resin and the sand is extended. The higher viscosity binder or resin gives higher green strength in the sand mixtures. Therefore, where higher green strength is desired, a more viscous resin or binder is preferred.

The sand-binder-accelerator mixture, when freshly made, is quite light in color, provided that the sand is light in color. On standing, the mixture gradually becomes darker. This change in color is a useful indicator of the degree of set and enables the operator to judge whether or not it is time to remove the pattern.

The core resulting from the process of this invention shows not only excellent sand wettability, but also storage stability extending over indefinite periods.

The term "core" as used in the description and claims

is intended to cover cores for foundry molds and as cavities into which molten metals are poured.

What is claimed is:

1. The process for making a core composed principally of sand which comprises preparing a liquid resinous binder made by heating urea, aqueous formaldehyde, and furfuryl alcohol, in the mole ratio of 1 to 2 of urea to 1 to 2 of formaldehyde, to 1 to 4 of furfuryl alcohol in the presence of a basic condensing agent, and thereafter distilling off the major amount of water, adding the binder and acidic accelerator therefor to sand in quantity sufficient to form said core, agitating the mixture to effect thorough dissemination of the binder and accelerator through the sand, packing the disseminated mass about a pattern to form a core, and allowing the core to cure without the application of any extraneous heat.

2. The process according to claim 1 wherein the proportions of sand to accelerator are 1000 parts of sand to 3 to 10 parts by weight of accelerator.

3. The process according to claim 2 wherein the proportion of binder is approximately 20 parts by weight.

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