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Nouveau

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[54] LININGS FOR INGOT MOLDS AND FOUNDRY MOLDS

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[58] **Field of Search** 117/5.1, 5.3, 160; 164/53, 164/72, 74, 121, 33; 106/38.22, 38.23, 38.27

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[57] **ABSTRACT**

An exothermic ingot mold lining is water insoluble and can be formed by filtration, but at the same time has high reactivity, and comprises by weight refractory material 35 to 60 percent, asbestos 3 to 7 percent, wood flour 4 to 10 percent, manganese dioxide 11 to 21 percent, cryolite 0.5 to 7 percent, fluorspar 0.5 to 6 percent, binder 4 to 7 percent, and powdered aluminum 10 to 32 percent, the aluminum substantially all passing a No. 45 screen and including 10 to 70 percent that passes a No. 250 screen. The aluminum is thus a mixture of fine and coarse powder.

2 Claims, No Drawings

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LININGS FOR INGOT MOLDS AND FOUNDRY MOLDS

The present invention relates to exothermic composition for the fabrication of mold elements used as linings for molds during the casting of metals and particularly for the lining of the upper portions of the molds. These linings serve to insulate the liquid metal or a portion of the liquid metal from the mold or the hot top of the mold so as to retard solidification of the metal, particularly adjacent the top of the casting.

The invention is more particularly concerned with exothermic mold linings for small castings in which the heat transfer is especially rapid and in which the temperature variations must be more closely regulated according to a predetermined and fairly precise pattern, than in the case of larger castings.

A number of exothermic compositions are already known that are suitable for ingot and foundry mold linings. Generally speaking, these are mixtures of powdered aluminum of the like, as the oxidizable element, and an oxidizer such as iron oxide, manganese dioxide or sodium or potassium nitrate. When an insoluble oxidant such as iron oxide or manganese dioxide is used in these mixtures, it is necessary also to use a relatively large percentage of a soluble oxidizer such as a nitrate and a flux which is also soluble, such as a fluoride, to facilitate oxidation of the aluminum by fusion of the outer layer of the aluminum.

At the same time, it is convenient to form these mold linings by the filtration of an aqueous suspension of the constituents. Therefore, it is practically impossible to use soluble oxidizers and fluxes in such a suspension. The high solubility of such constituents leads to irregular results and dictates the use of such constituents in the form of a paste or in a dry form.

In French Pat. Nos. 1,388,898 of Dec. 31, 1963 and 1,442,499 of May 6, 1965, exothermic or weakly exothermic compositions have been proposed which have no soluble components or only small percentages of soluble components, and which can accordingly be formed by filtration. At the same time, however, these known compositions are not as reactive as is desirable for use in connection with small castings.

The present invention remedies these shortcomings by providing an exothermic composition which has no soluble components and which is accordingly suitable for formation of a mold lining by filtration of a suspension, but which at the same time is of enhanced reactivity. The present invention is characterized by regulation of the grain size of aluminum powder, so as to obtain a staged or phased reaction with the first stage of exothermic reaction utilizing the air occluded in the molded material and a second stage of exothermic reaction utilizing insoluble oxidants for oxidation of the aluminum powder.

In accordance with this principle, and exothermic composition of the present invention is characterized in that it comprises, in addition to the insoluble oxidants such as iron oxide or manganese dioxide, which oxidants are in finely divided form preferably having an AFS index higher than 90, and in addition to fillers and insoluble components such as fluxes of refractory material, and a binder, powdered aluminum of which the grain size is graduated over a range of fineness such that substantially all of the aluminum powder passes a screen having openings of 0.40 mm., more than 95 percent by weight passes a screen having openings of 0.25 mm., more than 50 percent by weight passes a screen having openings of 0.16 mm., and 10 to 70 percent by weight passes a screen having openings of 0.063 mm.

In this mixture, it is the finest portion that has the greatest reactivity; and it is the portion of largest grain size whose oxidation is retarded until the temperature of the mold lining, under the combined heating action of the cast metal and the exothermic reaction of the finer particles, reaches the decomposition temperature of the insoluble oxidants. The proportion of the fine and coarse particles can accordingly be adjusted so as to regulate the reaction rate and hence the temperature of the lining at any moment. In practice, this granulometric curve is regulated by varying the proportion to each other of two powders of different particle sizes, one of the two powders having an average particle size less than 0.063 mm.

and the other of the two powders having an average particle size between 0.10 and 0.16 mm.

The insoluble fluxes of the mixture may be for example cryolite and fluorspar. The fillers and the refractory materials are those ordinarily used. The fillers may be organic or inorganic and simply control in the known manner the density and porosity of the molded lining and its strength and other properties such as adhesion to the casting. These fillers can also have a physical action, especially when they are in the form of mineral fibers or organic fibers, to ensure the dispersion of the heavier materials in the suspension and to improve the mechanical resistance of the lining. Refractory materials may for example be silica sand, fire clay, magnesia, etc., their density and grain size being chosen according to the desired porosity to be achieved.

The binders may be chosen as desired but phenolic resins and ureaformaldehyde resins are preferred, as well as organic binders such as starch or potato starch, etc. When choosing the binder or mixtures of binders, attention should also be paid to the degree to which the binder will take up water after the lining is dried.

More particularly, the exothermic linings of the present invention can have the following weight per cent composition:

Refractory material (silica sand, fire clay or magnesia) with a granulometric index from 90 to 150 AFS	35 to 60
Asbestos (e.g., chrysotile or amosite)	3 to 7
Wood flour	4 to 10
Manganese dioxide	11 to 21
Cryolite	0.50 to 7
Fluorspar	0.50 to 6
Powdered aluminum having granulometry according to the present invention	10 to 32
Binder (e.g., synthetic resin or starch, etc.)	4 to 7

To fabricate the lining, the above mixture is suspended in water in a concentration of 150 to 400 grams of solids per liter. The suspension is introduced into a mold having perforated mold walls and the water is forced through the perforations by pressure, leaving moist solids in the desired shape of the lining. The moist solid pieces are then oven dried to total dryness.

In order to enable those skilled in this art to practice the invention, the following illustrative example is given:

Two aluminum powders, A and B, were provided. The powders had the following granulometry:

(A) Screen No.	Mesh Opening (mm.)	Percent Refused
45	0.40	Less than 0.1
60	0.25	Less than 0.1
100	0.16	0.8
150	0.10	9.8
250	0.063	22.6
Balance	—	66.8

(B) Screen No.	Mesh Opening (mm.)	Percent Refused
45	0.40	Less than 0.2
60	0.25	9.4
100	0.16	38.8
150	0.10	33.2
250	0.063	12.4
Balance	—	6.2

The weight percent composition embodying these powders was as follows:

Silica sand, having a fineness of 140 AFS	51.50
Asbestos	5
Wood flour	6
Manganese dioxide	13.50
Cryolite	1
Fluorspar	3
Aluminum powder A	15
Aluminum powder B	5

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Powdered phenolic resin	6.5

The mixture was suspended in water at a concentration of 300 g. of solids per liter and was formed by filtration as described above into the lining for the top of a steel ingot mold for casting a chromium steel ingot weighing 90 kgs. Specifically, the lining was in the form of a sleeve 18 mm. thick bordering about the upper 8.5 percent of the volume of the interior of the mold. The resultant cast chrome steel ingot had pipe and inclusions only at the top and amounting to only 4 percent by weight of the casting.

As will be evident to those skilled in this art, the present invention is not restricted to the examples given but is susceptible to numerous modifications without departing from the scope of the appended claims.

Having described my invention, I claim:

1. A mold element for the exothermic lining of an ingot mold, consisting essentially of 10 to 32 percent by weight of powdered aluminum substantially all of which passes a screen having openings of 0.40 mm. and 10 to 70 percent by weight of which passes a screen having openings of 0.063 mm., 35 to 60 percent by weight of a refractory material having a granulometric index from 90 to 150 AFS, 3 to 7 percent by weight of asbestos, 4 to 10 percent by weight of wood flour, 11 to 21 percent by weight of an oxidant selected from the group consisting of iron oxide and manganese dioxide, 1 to 13 percent of a water insoluble flux and 4 to 7 percent by weight of an organic binder.

2. An ingot mold lining as claimed in claim 1, in which more than 50 percent of said aluminum powder passes a screen having openings of 0.16 mm.

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