United States Patent [19]

Tisza

[11] **3,878,142**

[45] **Apr. 15, 1975**

[54] **COMPOSITIONS FOR LINING CASTING MOULDS AND RELATED ARTICLES AND METHOD OF MAKING SUCH ARTICLES**

[75] Inventor: **Julianna Tisza,** Mailand, Italy

[73] Assignee: **Firma Tidd Chemisch-technische Produkte G.m.b.H.,** Vienna, Austria

[22] Filed: **Dec. 4, 1972**

[21] Appl. No.: **311,868**

[30] **Foreign Application Priority Data**

Dec. 3, 1971 Austria 10442/71

[52] **U.S. Cl.** ..... **260/17.2;** 106/38.22; 106/38.2; 106/38.23; 106/38.25; 260/38; 260/39 R; 264/30

[51] **Int. Cl.** **C08g 51/18**

[58] **Field of Search** 260/17.2, 17.3, 38–39; 106/38.27, 38.22, 38.23, 38.2

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Primary Examiner—Melvin Goldstein
Assistant Examiner—Edward Woodberry
Attorney, Agent, or Firm—Ernest F. Marmorek

[57] **ABSTRACT**

A lining for metallurgical purposes comprises 80 – 90 wt.% of aluminum waste metal, 1 – 19 wt.% of fibrous filler, 1 – 10 wt.% of binding agents, such as phenoplasts or aminoplasts and up to 1 wt.% of wetting agent. The lining may be adapted for specialised purposes by replacing up to a quarter of the aluminum waste metal by additional constituents suited to the required purpose. The lining may be made by a dry process in which dry flakes of the composition are pressed to a desired shape or by a wet process in which the aluminum waste metal is added to an aqueous mixture of the fibrous filler and wetting agent whereafter the other constituents are added. Refractory, insulating and exothermic linings are described.

8 Claims, No Drawings

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COMPOSITIONS FOR LINING CASTING MOULDS AND RELATED ARTICLES AND METHOD OF MAKING SUCH ARTICLES

SUMMARY OF THE INVENTION

This invention relates to a lining for metallurgical purposes and to a method of making the same.

In the casting of iron, steel or non-ferrous metals, plates or hollow moulded members are used for lining ingot mould hoods, mould attachments, risers, gates and the like. The plates or hollow moulded members are usually made from an exothermic material or an insulating material or a combination of the two, or may be laminated. Such plates are mainly ceramic, but it has recently been proposed to use plates and lining materials in which the main constituent is cellulosic in nature, e.g. wood chips or paper and other organic or inorganic fibrous materials. When such linings are manufactured, however, it is usually necessary to mix a number of substances, to convert them into a slurry in large containers and to remove large quantities of liquid, e.g. by suction, during a final shaping operation, which requires undesirably expensive apparatus.

It is an object of the invention to provide a lining material which is light-weight, easy to shape and much simpler to manufacture than previously proposed cellulosic lining materials, and which can also be adapted without difficulty to the requirements of foundry practice. It has now been discovered that aluminum waste metal, i.e. the solidified scum and smelting material obtained during the electrolytic manufacture or remelting of aluminum or aluminum alloys, is eminently suited for the production of linings for metallurgical purposes. It has already been proposed to use this substance in foundry practice in association with exothermic pipe eliminators, in which case use is made of the property of a limited quantity of aluminum waste metal to harden automatically when strongly heated. Hitherto, however, it has not appeared possible to use a composition consisting mainly or entirely of aluminum waste metal, since the strong heating required for forming a slurry or paste with water destroys the binding agents required for such compositions, particularly the prior-art plastics binders containing formaldehyde resin or urea formaldehyde resin.

It has now been found that even if the content of aluminum waste metal is very high, a very serviceable lining material, which is sufficiently strong for use as a metallurgical lining material and can be adequately shaped, can be obtained if the high content of waste metal is combined with a small content of fibrous fillers and wetting agents, thus eliminating the otherwise unavoidable disintegration of the binder for cementing the finished lining together.

Accordingly, one aspect of the present invention provides a lining for metallurgical purposes comprising

80 – 90 wt.% of aluminum waste metal,
1 – 19 wt.% of fibrous filler,
1 – 10 wt.% of binding agent, and
up to 1 wt.% of wetting agent,

with the proviso that up to a quarter of the aluminum waste metal can be replaced by at least one other constituent for adapting the lining to a required purpose.

The binding agent is preferably one comprising a plastics, e.g. a phenoplast or aminoplast, and the composition preferably contains from 0.1 to 0.5 wt.% of the wetting agent.

The present lining material, when converted into plates and other pre-shaped moulded members, is very suitable for a variety of requirements in foundry practice, has the mechanical strength and resistance to abrasion required during heating and use, can be used in the production of small castings having a clean surface and is easy to manufacture. The density of the finished lining plate is relatively low, e.g. only approximately 0.8.

Without wishing to be bound by any theory, it is believed that the effectiveness of the present lining material with a high content of aluminum waste metal together with fibrous material and a wetting agent is due to the fact that the wetting agent apparently "immunises" or passivates the waste metal, which otherwise has a violent, strongly exothermic reaction with water, so that the waste metal can safely be processed with water and does not impair the operation of plastics or similar binders, in contrast to prior-art experience.

As already mentioned, the present lining can contain additional constituents depending upon the required applications. The proportion, however, of additional constituents which may replace the main constituent of the composition (i.e. aluminum waste metal) should not be great enough to impair the advantageous combination of waste metal with fibrous material, the wetting agent and the binding agent. If not more than a quarter of the aluminum waste metal is replaced by additional constituents, i.e. if the total substance contains more than 60% of waste metal, the lining still has the desired properties.

If the lining is used for exothermic purposes, the specified composition is preferably altered by adding a thermit-like substance, such as a mixture of aluminum and iron oxide or a similar mixture comprising an oxidisable metal and an oxygen carrier such as manganese dioxide or an alkali-metal nitrate or chlorate. If such a lining is used, the extent of the exothermic effect can easily be adjusted as required by replacing a variable amount of the aluminum waste metal by the exothermic mixture, without impairing the advantageous properties of the lining.

If the main requirement is that the lining should be highly refractory, the additional components replacing up to a quarter of the waste-metal content may be insulating materials such as fireclay, clay, bentonite, sand, dolomite, kieselguhr or the like.

If required, the lining can contain light-weight fillers such as expanded clay, expanded corundum, vermiculite, perlite, light fireclay or the like, which can likewise replace the waste-metal content to the extent specified, thus giving very low-density linings this being particularly useful where the lining is in the form of plates.

The additional components can also be used to adjust the properties of the lining material after use. After coming into contact with the melt, the lining is sintered and, after the casting and cooling process has ended, forms a cohesive member which can be taken out as a whole. Alternatively, the composition of the lining can be adjusted by admixtures so that the lining disintegrates after casting.

The fibrous filler forming part of the composition of the present lining is preferably an inorganic fibrous filler such as asbestos, amosite, glass fibers, mineral wool or the like, asbestos fibers being particularly pre-

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ferred. If required, however, the lining can also contain organic fibrous materials, such as saw-dust, rice straw or other cellulosic fibers or plastics fibers or the like, which may also be refractory.

The solids out of which the lining is constructed are usually used in finely-divided form. Advantageously, in order to ensure a very uniform effect, the aluminum waste material, binder and other constituents, if present, should have a particle size between "very fine" and 2.5 mm., and at least half the particles should have a maximum size of 1 mm..

According to another aspect of the present invention there is provided a method of manufacturing the present lining. In this method, the fibrous filler is mixed with the wetting agent, preferably in an aqueous preparation thereof, and more water is added if necessary, after which finely-divided aluminum waste metal is introduced into the aqueous mixture, the binder or components thereof are added and the whole is given further treatment to form a mixture which can be formed into a casting for the desired lining and dried to give the finished product.

Advantageously, the mixture containing all the constituents is further processed by converting it into a pasty material, adding water if necessary, placing the pasty material on a porous or sieve-like support and shaping it by suction or pressure into castings which have sufficient green strength to be handled.

In an alternative form of the manufacturing process, a substantially dry method can be used, in which case the mixture of all the constituents is processed under dry conditions to form dry flakes which can immediately be pressed into castings having the desired shape.

Irrespective of the manner in which a casting is obtained, it is advantageously finally dried in an oven at a temperature of about 145° to 310°C., depending upon the nature of the binder used and until the binder hardens.

The wetting agents which may be used in preparing the present composition can be conventional products known in the detergent industry, provided they are suitable for the purpose of the invention. The following substances are examples of those which are suitable: anion-active compounds such as alkylbenzene sulfonates, alkyl sulfates and sulfonates, sulfated fatty acid esters, or non-ionisable substances such as alkoxylated fatty acid condensation products or the like, and various mixtures of these substances. Advantageously the wetting agents are used in the form of liquid concentrates in the manufacture of the lining.

In one embodiment of the present invention, a lining designed to have a predominantly exothermic effect, wherein up to a quarter of the content of aluminum waste metal is replaced by suitable constituents, can have substantially the following composition:

60 – 80	wt.% aluminum waste metal
1 – 6	wt.% asbestos fibers
0 – 6	wt.% saw-dust
3 – 6	wt.% phenol-formaldehyde resin
0.01 – 0.5	wt.% wetting agent
7 – 10	wt.% powdered aluminum
3 – 6	wt.% iron oxide and/or pyrolusite and
0 – 6	wt.% cryolite.

Of course, the binding agent need not be a plastics binder but can be another substance such as petroleum pitch, dextrin, a tar product, sulfite waste liquor or the like.

DETAILED DESCRIPTION OF THE INVENTION

The following non-limitative examples are given in order to illustrate the invention.

EXAMPLE 1

The following constituents were used in order to prepare a highly refractory lining material:

Aluminum waste metal	84%
Asbestos fibers	5%
Binder (phenolic resin)	9%
Wetting agent (an approximately 20% mixture of alkylbenzene sulfonate and an ethoxylated fatty acid condensate)	2%

The asbestos fibers were thoroughly mixed with at least the same weight of water and with the wetting agent and further water was added to given a highly fluid or pourable mixture. Finely-ground aluminum waste metal was then added to form a uniform slurry, after which the binding agent was added and the mixture was compressed over a sieve connected to a source of suction, to form a plate-like cake. Drying for 2 hours at 250°C. produced a hardened plate about 25 mm. thick, which was ready for immediate use for lining an ingot hood for steel casting.

EXAMPLE 2

The following mixture was used in the manufacture of an insulating plate:

Aluminum waste metal	86%
Asbestos fibers	4%
Saw-dust	4%
Binder (phenolic resin)	4%
Same wetting agent as in Example 1	2%

The plate was manufactured in the manner described in Example 1, i.e. the asbestos fibers and the saw-dust were first treated with the wetting agent. The drying temperature however, was only 255°C. and the drying was conducted for 3 hours.

EXAMPLE 3

An exothermic lining was manufactured from the following mixture:

Aluminum waste metal	70%
Asbestos	4%
Saw-dust	4%
Binder (phenolic resin)	4%
Same wetting agent as in Example 1	1%
Finely-divided metallic aluminum	9%
Colcothar	4%
Cryolite	4%

The finished lining plate was manufactured by the same method as described in Example 1, except that the constituents of the exothermic mixture were

worked into the slurry between the time when the aluminum waste metal and the binder components were added.

What is claimed is:

1. A lining for metallurgical purposes comprising
60 – 90 wt. % of aluminum waste metal,
1 – 19 wt. % of fibrous filler,
1 – 10 wt. % of binding agent, wherein the binding agent is selected from the group consisting of phenoplasts and aminoplasts,
0.01 – 1 wt. % of wetting agent, wherein the wetting agent is selected from the anion-active compounds and non-ionic compounds and mixtures thereof,
0 – 22.5 wt. % additional constituents selected from the group consisting of exothermic materials, insulating materials, lightweight fillers.

2. The lining of claim **1** adapted as an exothermic lining, wherein the other constituent is a mixture of aluminum and iron oxide.

3. The lining of claim **1,** wherein the lightweight filler is selected from expanded clay, expanded corundum, vermiculite, perlite and light fireclay.

4. The lining of claim **1,** wherein the wetting agent is selected from alkylbenzene sulfonates, alkyl sulfates, alkyl sulfonates, sulfated fatty acid esters and alkoxylated fatty acid condensation products.

5. A lining for metallurgical purposes having a predominantly exothermic effect, comprising
60 – 80 wt. % of aluminum waste metal,
1 – 6 wt. % of asbestos fibers,
0 – 6 wt. % of sawdust,
3 – 6 wt. % of phenol-formaldehyde resin,
0.01 –0.5 wt. % of wetting agent selected from anion-active and non-ionic compounds,
7 – 10 wt. % of powdered aluminum,
3 – 6 wt. % of iron oxide and/or pyrolusite, and
0 – 6 wt. % cryolite.

6. In a method of preparing a lining for metallurgical purposes comprising
60 – 90 wt. % of aluminum waste metal,
1 – 19 wt. % of fibrous filler,
1 – 10 wt. % of binding agent selected from phenoplasts and aminoplasts,
up to 1 wt. % of wetting agent selected from anion-active compounds and non-ionic compounds and mixtures thereof,
0 – 22.5 wt. % additional constituent selected from the group consisting of exothermic materials, insulating materials, lightweight fillers, the method steps of providing an aqueous preparation of the fibrous filler and wetting agent, adding the aluminum waste metal in finely divided form, in the case of an exothermic mixture together with the components of the mixture, adding the binder or components reactive to form the binder, treating the resulting mixture to render it suitable for forming into the desired shape of the lining, forming the lining and drying the formed lining to harden it.

7. The method as claimed in claim **6,** including the processing of the resulting mixture in a drying process and during the drying process forming dry flakes or pellets and pressing said flakes or pellets into a desired mold shape.

8. The lining of claim **6,** wherein the wetting agent is selected from the group consisting of alkylbenzene sulfonates, alkyl sulfates, alkyl sulfonates, sulfated fatty acid esters and alkoxylated fatty acid condensation products.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,878,142 Dated April 15, 1975

Inventor(s) Julianna Tisza

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the name of the assignee, change "Tidd" to

-- Tido --.

Signed and Sealed this

twenty-second Day of *July 1975*

[SEAL]

Attest:

RUTH C. MASON
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