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Flash dressing for use in foundry practice

The present invention relates to the use of flash dressings in foundry practice.

It is conventional to coat porous moulds and cores with a dressing which serves as a barrier between molten metal and e.g. the sand in the casting process. By its use, a number of other casting defects are prevented. Where hardened sands are used it is customary to apply a dressing in the form of a water-based coating by brush, swab or spray gun. Such water-based coatings may comprise a base or filler and a liquid vehicle. The filler may be carbonaceous, graphitic, or based on a mineral flour such as zircon. The dressing is normally bonded by a clay-based binder.

In the case of chemically-hardened sands, it is necessary to use dressings in which the vehicle is a volatile liquid which can be "flashed-off" by ignition. Such dressings for instance may be pure organic solvents or mixtures of organic solvents. Volatile liquids now commercially in use include isopropyl alcohol, and mixtures of ethoxy ethanol with isomeric butanols or white spirit 50:50. Other mixtures used for this purpose include mixtures of ethoxyethanol and liquid hydrocarbons. All these dressings suffer from one or more of the following disadvantages:

1. Isopropyl alcohol when used alone is highly inflammable (flash point below 90°F equivalent to 32°C) which imposes restrictions on its use.

2. Some dressings such as those containing a high proportion of liquid hydrocarbons generate smoke on burning and are hence undesirable.

3. Yet others are either difficult to ignite or, if ignited, do not burn-off completely from the core treated therewith.

4. Mixtures containing liquid hydrocarbons may have a low level of water tolerance which is undesirable.

5. Mixtures containing ethoxyethanol are relatively uneconomic.

An ideal solvent or solvent mixture should be economic and should preferably be compatible with a high proportion of relatively inexpensive solvents without suffering any of the above disadvantages. Recent legislation in several countries relating to highly inflammable liquids is those with a flash point below 90°F, has imposed restrictions on the use of conventional dressings such as isopropyl alcohol and industry is tending to seek dressings which have a flash point above 90°F.

It has now been found that the above disadvantages may be minimized by using specific compositions which have the properties desirable in a flash dressing.

Accordingly, the present invention is a flash dressing for foundry cores comprising a mixture of diacetone alcohol and at least one C_1—C_4 monohydric alcohol such that the ratio of diacetone alcohol to monohydric alcohol in the mixture is at least 0.6:1 when mixed with a C_4 monohydric alcohol and at least 9:1 when mixed with a C_1—C_3 monohydric alcohol by volume.

The C_1—C_4 monohydric alcohols in the compositions of the present invention are preferably saturated monohydric alcohols selected from methanol, ethanol, isomeric propanols, and isomeric butanols. Foundry flash dressings containing mixtures of diacetone alcohol with either isopropanol or one or more of secondary butanol and iso-butanol are preferred. Mixtures having the desired flash point may be achieved by using a composition containing for example 40% diacetone alcohol and 60% isobutanol or 90% diacetone alcohol and 10% isopropanol.

To prevent metal penetration into the interstices of the sand grains, refractory fillers may be used. These fillers may be carbonaceous, graphitic or mineral based. The fillers are similar to those of water-based dressings but in this case the binder may be a resinous material. "Blackings", carbonaceous, graphitic and mineral based fillers are preferred.

In the flash dressings of the present invention suspension agents such as bentonite may be added to prevent the settling out of heavy fillers during use. Other minor components such as iron-oxide may be added to mould coatings to assist in preventing reaction between nitrogen-containing bonding agents and molten ferrous metals. This latter reaction is usually responsible for defects such as "pinholing" under the casting surface. Smoke supressants such as for example ferrocene may also be added to the flash dressing compositions. In some cases addition of a minor proportion, e.g. up to 20% by volume of the total composition, of a liquid hydrocarbon aids not only to burn off completely the flash dressing applied to the casting but also enhances the luminosity of the flames. This is desirable in some instances to ensure that the flash dressing has in fact been ignited. The amount of liquid hydrocarbon is suitably not more than 15%, preferably not more than 10% by volume of the total composition.

The flash dressings of the present invention may be brushed, sprayed or swabbed onto the mould surface. Where small cores are being dressed, the components may be dipped into the liquid dressing suspension.

After application, the mould is ignited, leaving behind a film on the surface of the sand, and when the casting has been made, the sand core can then be broken away easily leaving a smooth surface on the casting.

The invention is further illustrated with reference to the following tests the results of which are tabulated below. The results in Table 1 are Comparative Tests not according to the invention. The results in Table 2 illustrate the present invention.

1. Smoke Tests

(a) The amount of smoke produced by a dressing was assessed by pipetting 2 ml of the dressing into a borosilicate glass evaporating dish and igniting the sample. A white background made the smoke easily visible. Measurements were made qualitatively and were assessed visually on a 1 to 4 scale of the amount of smoke produced as follows:

1 — no smoke produced

2 — slightly smoky

3 — smoky

4 — very smoky

The value for each dressing was determined by visual comparison with two solvents isopropanol and a mixture of low aromatic white spirit with ethoxy ethanol (50:50). The results of the above tests which were carried out only with dressings which had a flash point above 90°F are shown in Table 1 below.

(b) The visual smoke tests were supplemented by qualitative particulate smoke test in which a sample of the particulate smoke was collected on a fibreglass filter. This method of assessing smokiness (suitable for comparing small amount of smoke not readily visible to the naked eye when the dressing is burning) was carried out in the same manner as in 1 (a) above except that a 3 ml sample of the dressing was measured into the evaporating dish with a syringe. The dressings were ignited and a chimney (a 2-litre conical flask with the base removed) was positioned over the flame. The particulate smoke was collected on an atmospheric dust filter of fibre-glass positioned 3 cm above the top of the chimney. The fibre-glass filter was connected to a pump drawing 2-litres of air per minute through the filter. Measurements were made qualitatively and were assessed visually on a scale from white to black in colour for the amount of smoke produced as follows:

white	—	no smoke produced
light grey	—	slightly smoky
grey	—	smoky
black	—	very smoky

The results of these tests are also shown below in the Tables.

This test was used to evaluate more accurately the smokiness of the dressings tested in 1 (a) above.

2. Flash Point Tests

The flash point of various dressings listed in 1 above was measured using the Abel closed cup apparatus according to the Institute of Petroleum Standard Test No. IP 170/70.

The results of these tests are also shown in the Tables below:

TABLE 1

(COMPARATIVE TESTS NOT ACCORDING TO THE INVENTION)

Test No.	Dressing Mixture or Solvent	Flash Point °F	Particulate Smoke Test Rating	Visual Smoke Test Rating
(a)	Methanol	54	White	1
(b)	Ethanol	54	White	1
(c)	Isopropanol	53	Light grey	2
(d)	Sec-butanol	70	Grey	2
(e)	Iso-butanol	77	Light grey	2
(f)	Butyl propionate	101	Black	3
(g)	Amyl acetate	90	Black	3
(h)	Diacetone alcohol	139	White	1
(i)	White spirit	104	Black	4
(j)	Low aromatic white spirit (LAWS)	95	Black	3
(k)	LAWS + Ethoxy ethanol (1:1, v/v)	92	Black	3
(l)	LAWS + Hexylene glycol (2:1, v/v)	109	Black	3
(m)	LAWS + Diacetone alcohol (1:1, v/v)	102	Black	2
(n)	n-Butyl acetate + Diacetone alcohol (1:9, v/v)	115	Grey	2

TABLE 2

(EXAMPLES ACCORDING TO THE INVENTION)

Ex. No.	Dressing Mixture	Flash Point °F	Particulate Smoke Test Rating	Visual Smoke Test Rating
1	Diacetone alcohol (DAA) + Methanol (9:1, v/v)	90	White	1
2	DAA + Ethanol (9:1, v/v)	93	White	1
3	DAA + Isopropanol (9:1, v/v)	95	White	1
4	DAA + Sec-butanol (2.3:1, v/v)	91	White	1
5	DAA + Isobutanol (0.6:1, v/v)	93	White	1
6	DAA + Isobutanol (1.5:1, v/v)	99	White	1
7	DAA + Isobutanol (0.67:1, v/v) + LAWS (3%)	90	Light grey	1
8	DAA + Isobutanol (0.69:1, v/v) + cumene (9%)	91	Grey	2
9	DAA + Isobutanol (0.69:1, v/v) + colourless kerosine (9%)	93	Grey	2

3. Ignition tests

Some of the dressings listed in 1 above were tested for their ease of ignition by igniting them as follows:

2 ml of some of the samples were pipetted onto a sand core and ignited with a match. The ease of ignition was rated as below:

isopropanol >60:40 diacetone alcohol/sec-butanol ≡40:60 diacetone alcohol/isobutanol >90:10 diacetone alcohol/isopropanol >diacetone/alcohol.

A typical formulation of a foundry flash dressing based on diacetone alcohol mixtures will be as follows:

Material	Parts by weight
Bentone 27	2
Zircon flour	70
Diacetone alcohol	10
Isobutanol	15

The dressing may contain in addition 1—2% by weight of a natural or synthetic resin such as a phenol-formaldehyde resin.

Claims

1. A flash dressing composition for foundry cores comprising a mixture of diacetone alcohol and at least one C_1—C_4 monohydric alcohol, such that the ratio of diacetone alcohol to monohydric alcohol in the mixture is at least 0.6:1 when mixed with a C_4 monohydric alcohol and at least 9:1 when mixed with a C_1—C_3 monohydric alcohol by volume.

2. A composition according to claim 1 wherein the said composition contains 40% diacetone alcohol and 60% isobutanol by volume.

3. A composition according to claim 1 wherein the said composition contains 90% diacetone alcohol and 10% isopropanol by volume.

4. A composition according to any of the preceding claims wherein said composition also contains in addition up to 10% by volume of a liquid hydrocarbon.

5. A composition according to any of the preceding claims wherein said composition contains in addition bentonite as a suspension agent.

6. A composition according to any of the preceding claims wherein said composition contains in addition smoke-suppressants.

Revendications

1. Composition d'enduit à élimination très rapide, pour des noyaux de fonderie, comprenant un mélange de diacétone-alcool et d'au moins un monoalcool en C_1—C_4 tel que le rapport du diacétone-alcool au monoalcool dans le mélange est au moins égal à 0,6:1 en cas de mélange avec un monoalcool en C_4 et au moins égal à 9:1 en cas de mélange avec un monoalcool en C_1—C_3, en volume.

2. Composition selon la revendication 1, dans laquelle cette composition contient 40% de diacétone-alcool et 60% d'isobutanol, en volume.

3. Composition selon la revendication 1, dans laquelle cette composition contient 90% de diacétone-alcool et 10% d'isopropanol, en volume.

4. Composition selon l'une quelconque des revendications précédentes, dans laquelle cette composition contient également, en outre, jusqu'à 10% en volume d'un hydrocarbure liquide.

5. Composition selon l'une quelconque des revendications précédentes, dans laquelle cette composition contient en outre de la bentonite comme agent de maintien en suspension.

6. Composition selon l'une quelconque des revendications précédentes, dans laquelle cette composition contient en outre des agents de suppression de la fumée.

Patentansprüche

1. Zusammensetzung für eine Abbrennauskleidung für Gießereikerne enthaltend eine Mischung von Diacetonalkohol und mindestens einem einwertigen C_1—C_4 Alkohol derart, daß das Volumenverhältnis von Diacetonalkohol zu einwertigem Alkohol in der Mischung mindestens 0,6:1 beträgt in einer Mischung mit einem einwertigem C_4 Alkohol und mindestens 9:1 in einer Mischung mit einem einwertigen C_1 bis C_3 Alkohol.

2. Zusammensetzung gemäß Anspruch 1, in welcher die Zusammensetzung 40 Volumenprozent Diacetonalkohol und 60 Volumenprozent Isobutanol enthält.

3. Zusammensetzung gemäß Anspruch 1, wobei die Zusammensetzung 90 Volumenprozent Diacetonalkohol und 10 Volumenprozent Isopropanol enthält.

4. Zusammensetzung gemäß einem der vorgehenden Ansprüche, worin die Zusammensetzung suzätzlich bis zu 10 Volumenprozent eines flüssigen Kohlenwasserstoffs enthält.

5. Zusammensetzung gemäß einem der vorgehenden Ansprüche, worin die Zusammensetzung zusätzlich Bentonit als Suspensionsmittel enthält.

6. Zusammensetzung gemäß einem der vorgehenden Ansprüche, worin die Zusammensetzung zusätzlich rauchunterdrückende Stoffe enthält.