

2159163

Title: "Method of preparing a foundry mould or core"

Description of Invention

The present invention relates to a method of preparing a foundry mould or core wherein there is mixed with a foundry aggregate, typically sand, a binder comprising an alkali phenolate, the mixture is formed to the required shape and an ester in gaseous form is passed into the shaped mixture to promote curing of the binder. Examples of such methods are disclosed in EP86615A.

We have discovered that the properties of the resulting core or mould can be improved by incorporating an ester in the mixture which is shaped before the ester in gaseous form is passed into the shaped mixture.

According to the invention, there is provided a method of preparing a foundry mould or core wherein there is prepared a mixture which includes a foundry aggregate, an ester and a binder comprising an alkali metal phenolate resin, said mixture is formed to the required shape and an ester in gaseous form is then passed into the shaped mixture.

Generally, the ester incorporated in the mixture in a method in accordance with the present invention is less volatile than is the ester passed into the shaped mixture.

The ester which is incorporated in the mixture is preferably mixed with the binder when the binder is mixed with the foundry aggregate.

As in examples given in EP86615A, the preferred binder contains a substantial amount of water and the alkali phenolate is preferably a resin which is at least partly dissolved in the water.

The weight of the ester incorporated in said mixture may be varied according to the nature of the ester used, the conditions of use and the required bench life. Generally, the weight of the ester in the mixture is within the range 0.5% to 7% of the weight of the binder in the mixture. The weight of resin in the mixture is preferably within the range 0.5% to 2.5% of the weight of the aggregate in the mixture.

Suitable examples of the weight average molecular weight of the resin present in the binder are disclosed in EP 86615A. However, we have found that satisfactory cores can be achieved by the method of the present invention when the weight average molecular weight of the resin in the binder is lower than the range specified in EP 86615A. Thus, the binder used in a method according to the present invention may comprise resin with a weight average molecular weight as low as 450. The weight average molecular weight of resin in the binder is preferably at least 500 but is preferably no greater than 1500 and more preferably does not exceed 1000.

A silane may be incorporated in the mixture, as proposed in EP 86615A.

The molar ratio of alkali to phenol is preferably within the range 0.5% to 1%.

The ester which is passed in gaseous form through the shaped mixture may be a lower alkyl formate, as proposed in EP 86615A. Suitable esters for incorporation in the mixture prior to shaping include diacetin and triacetin. The ester may be a lactone, for example butyro lactone.

In table I, there are set out transverse strengths achieved in a number of examples of a method in accordance with the present invention. In each of these examples, there was prepared a phenol formaldehyde resin having a molar ratio of phenol to formaldehyde within the range 1:1.7-1:2.0. The phenol and formaldehyde were condensed in the presence of an aqueous solution of an alkali, for example sodium hydroxide. The molar ratio of phenol to alkali was 1:0.625. Condensation was carried out until the viscosity of the mixture at 25°C was 310 centipoise. The resin resulting from the condensation remained in solution in the water present.

The weight average molecular weight of the resin in the solution, as determined by gel permeation chromatography of a sample of the resin solution used in the examples of table I was found to be 570. A further sample of the resin solution was acidified with sulphuric acid to precipitate resin which was separated, washed and subsequently dissolved in a solvent. The weight average molecular weight of the resin in the solution thus obtained was determined by gel permeation chromatography to be 670.

A quantity of foundry sand, an amount of the aqueous resin solution equal to 1.5% of the weight of sand and an amount of a liquid ester equal to 2.5% of the weight of resin solution were introduced into a mixer and mixed together to provide a substantially homogenous mixture which was then transferred to a vented core box. The temperature of the core box and of the

sand introduced into the mixer were 21°C. A mixture of nitrogen and a volatile ester, methyl formate, was drawn through the shaped mixture in the core box for a period of ten seconds. The shaped mixture was then purged with nitrogen. The transverse strengths of the resulting cores were measured twenty seconds, fifteen minutes and twenty four hours after gasing. The measured strengths and the liquid esters used are indicated in table I.

As shown in table I, certain samples were gased with a mixture comprising equal parts, by volume, of methyl formate and nitrogen, other samples were gased with a mixture comprising 35% methyl formate and 65% nitrogen, by volume, whilst further samples were gased with a methyl formate-nitrogen mixture comprising only 25% methyl formate by volume.

The sodium phenolate is preferably the phenolate of phenol, C_6H_5OH , but sodium salts of other phenols may be used. The preferred aldehyde is formaldehyde but other aldehydes may be used in conjunction with, or in place of formaldehyde.

The reaction between the aldehyde and the sodium phenolate is preferably carried out by dissolving all of the phenol required for preparation of the resin in an aqueous solution containing all of the sodium hydroxide required for preparation of the resin solution and then adding formaldehyde slowly so that the concentration of free aldehyde in all parts of the solution is always at a low level. Alternatively, some of the required sodium hydroxide may be introduced after addition of the formaldehyde has been completed, for example after the reaction between the formaldehyde and the sodium phenolate has substantially ceased.

The molar ratio of phenol to aldehyde used in preparation of the resin composition is preferably within the range 1 : 1 to 1 : 3 and is more preferably within the range 1 : 1.3 to 1 : 2.5.

There may be substituted for some or all of the sodium hydroxide used in preparation of the binder an equivalent amount of potassium hydroxide.

Whilst methyl formate is the preferred ester for use in gasing the shaped mixture, other lower alkyl formates may be used. If required, heat may be supplied to the volatile ester in its liquid form to promote evaporation.

TABLE 1

Liquid ester	1" Transverse strength (kgf/cm ²) after :									
	50% Formate			35% Formate			25% Formate			
	20 secs	15 mins	24 hours	20 secs	15 mins	24 hours	20 secs	15 mins	24 hours	24 hours
None	11.8	14.1	16.4	10.8	12.7	13.2	8.8	10.2		10.8
Diacetin	15.2	16.5	21.1	12.8	13.4	13.4	9.5	10.7		10.9
Triacetin	15.7	19.4	21.1	14.4	15.0	15.2	12.9	14.3		14.3
E.G.D.A.	12.9	16.5	18.5	12.8	14.5	15.0	9.8	11.7		12.3
Imsol 'R'	15.6	17.3	21.9	13.2	14.2	14.2	10.3	12.1		12.0
PH 60	10.6	16.0	17.1	13.7	14.2	14.5	10.5	12.9		13.1

In table 1, the abbreviation E.G.D.A. represents ethylene glycol diacetate. Insol "R" and PH60 are mixtures of esters, the later comprising 70% glycerol triacetate, together with dimethyl esters of dibasic acids. Insol "R" is a commercially available mixture of esters, including dimethyl esters of dibasic acids.

12



5

CLAIMS:-

1. A method of preparing a foundry mould or core wherein there is prepared a mixture which includes a foundry aggregate, an ester and a binder comprising an alkali metal phenolate resin, said mixture is formed to the required shape and an ester in gaseous form is then passed into the shaped mixture.
5
2. A method according to Claim 1 wherein the binder contains a substantial amount of water and said phenolate is a resin which is at least partly dissolved in the water.
10
3. A method according to Claim 1 or Claim 2 wherein the ester incorporated in said mixture is less volatile than is the ester passed into the shaped mixture.
- 15 4. A method according to any preceding Claim wherein the ester incorporated in said mixture is mixed with the binder when the binder is mixed with the foundry aggregate.
- 20 5. A method according to any preceding Claim wherein the weight of ester in said mixture is within the range 0.5% to 7% of the weight of binder in the mixture.
- 25 6. A method according to any preceding Claim wherein the weight average molecular weight of the resin present in the binder is within the range 450 to 1500.
- 30 7. A method according to Claim 6 wherein the resin is a phenol-formaldehyde resin, the weight of formaldehyde is within the range 1.7 to 2 times the weight of phenol and the weight average molecular weight of the resin in the binder does not exceed 1000.
8. A method according to any preceding Claim wherein the weight of resin in the mixture is within the range 0.5% to 2.5% of the weight of the aggregate in the mixture.



14

9. A method according to any preceding Claim wherein the molar ratio of alkali to phenol is within the range 0.5% to 1%.
-