

PATENT SPECIFICATION

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(54) IMPROVEMENTS RELATING TO FOUNDRY BINDERS

(71) We, FORDATH LIMITED, a British Company of Brandon Way, Albion Road, West Bromwich, West Midlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

5 This invention relates to a method of producing foundry moulds or cores. 5

In British Patent Specification No. 1,405,116, there is described a method of preparing a foundry core in which there is mixed with sand a solution of bisphenol-A and a solution of a polyisocyanate, the mixture is formed to the required shape and is then cured by passing triethylamine through the mixture. We have found that the strength of cores formed by this method decreases over a period following curing, and that this decrease in strength is such as to make the method unsuitable for foundry use. 10

We have discovered that this disadvantage can be reduced or overcome by modifying the binder used in the method.

15 According to a first aspect of the present invention there is provided a method of producing a foundry mould or core wherein a polyisocyanate is modified by reacting some of the isocyanate groups present, with a drying oil, the modified polyisocyanate and a polyhydroxy composition are mixed with an aggregate, the mixture is formed to the required shape and is set by the reaction of the modified polyisocyanate with the polyhydroxy composition. 15

20 The polyisocyanate may comprise di- and/or tri-functional isocyanates. Commercially available mixtures of these may be used. Alternatively, polyisocyanates containing more than three functional groups may be used. 20

By a polyhydroxy composition we mean herein a compound whereof each molecule includes at least two hydroxyl groups, or a mixture of such compounds, or a mixture of compounds which react to form molecules each comprising at least two hydroxyl groups. 25 The composition may include a phenol-formaldehyde reaction product. 25

The reaction of the isocyanate and the polyhydroxy composition may be catalysed by one of the many well known catalysts as listed in the book "Polyurethanes: Chemistry and Technology" by Saunders and Frisch, published by Wiley in 1962. The catalyst may be in gaseous form, for example the vapour of a tertiary amine, or in liquid form. 30

The relative amounts of polyisocyanate and polyhydroxy composition are preferably such that, before modification, there is an excess of isocyanate groups, as compared with hydroxyl groups. 30

35 One example of a method in accordance with the first aspect of the invention will now be described. A polyhydroxy composition having the following composition by weight is made 35

up:-

	Bisphenol -A	50%	
5	Polyether polyol	3%	5
	solvent	47%	

- 10 To assist the process of dissolving the bisphenol-A, the three constituents are warmed and stirred together until a clear solution is obtained. 10

The particular polyol used is that sold under the designation G 600 by Lanko Chemicals Limited of Eccles. The solvent used is 2-ethoxyethylacetate.

- 15 A polyisocyanate is modified by raw linseed oil in the following manner. A mixture of the polyisocyanate and linseed oil is heated to a temperature of approximately 145°C. for approximately 15 minutes. The mixture is then cooled and a solvent is added. The amounts used are such that the proportions, by weight, in the modified polyisocyanate solution are as follows:- 15

20	polyisocyanate	67.5%	20
	raw linseed oil	22.5%	
25	solvent	10%	25

- 30 The polyisocyanate used is an aromatic polyisocyanate sold by I.C.I. Chemicals Limited under the designation EDP 6503. This is of the diphenylmethane di-isocyanate type. The linseed oil is supplied by British Oil and Cake Mills Limited. The solvent is a petroleum fraction sold by Esso Chemicals Limited under the designation Solvesso 100. (Solvesso is a Trade Mark). 30

- 35 The polyhydroxy composition and the modified polyisocyanate solution are mixed together with foundry sand, the weight of di-isocyanate solution being twice that of the polyhydroxy composition. The mixture is charged into a core box and formed to the required shape. A tertiary amine in gaseous form is then passed through the core box for a few seconds, after which the core box is purged by an inert gas. The core is then cured sufficiently for it to be removed from the core box. 35

- 40 The binder may be mixed with the sand by either a continuous mixing process or a batch mixing process, since the mixture of binder and sand has a bench life under normal conditions of temperature and humidity of at least one or two hours. The amount of binder used with a given weight of sand depends upon factors which include the required core strength and the character of the sand and may be similar to the amounts of known cold setting binders which are used in foundries at the present time. 40

- 45 As an alternative to the gaseous catalyst for curing the binder, there may be used a non-gaseous catalyst which is mixed with the binder and sand before the mixture is introduced into the core box. The catalyst may be a liquid amine or a solution of organo-metallic compound. 45

- 50 One or more of the solvents used is selected to provide that the catalyst will be soluble in the mixture of solvents which is present in the mixture which is introduced into the core box. Thus, in a case where an amine catalyst in gaseous form is passed through the core box, the solvent of the modified polyisocyanate and/or the solvent of the polyhydroxy composition is selected to provide that the mixture of solvents is capable of dissolving the amine catalyst. The solvents are also selected with a view to avoiding an excessively volatile solvent which would evaporate from the mixture between the stage of producing the mixture which includes the sand and the stage of forming this mixture to the required shape in the core box. 55

- 60 In a modification of the method hereinbefore described, the polyhydroxy composition which is mixed with the modified polyisocyanate solution and with the foundry sand contains an organosilane in a proportion up to 2% of the weight of the polyhydroxy composition. 60

- 65 The silane is selected from the silanes having the general formula $(RO)_3SiOR'$ where R is a hydrocarbon radical, preferably an alkyl radical of 1-6 carbon atoms and R' is a radical which is reactive with the isocyanate or the polyhydroxy composition or the polyurethane which is produced by reaction between these. R' is preferably $-CH_2-CH_2-CH_2-NH-CH_2-CH_2-NH_2$ and may be an alkyl, alkoxyalkyl, aminoalkyl, alkylaminoalkyl, or an 65

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epoxyalkoxyalkyl radical.

Attention is directed to our co pending application No. 30608/77, Serial No. 1601938, which describes and claims a method of preparing a foundry mold or core wherein there are reacted with a polyisocyanate a compound having an aliphatic hydroxyl functionality exceeding two and a compound having an aromatic hydroxyl functionality of at least two, the number of aromatic hydroxyl groups present in the mixture being greater than the number of aliphatic hydroxyl groups present.

WHAT WE CLAIM IS:-

1. A method of producing a foundry mould or core wherein a polyisocyanate is modified by reacting some of the isocyanate groups present with a drying oil, the modified polyisocyanate and a polyhydroxy composition are mixed with an aggregate, the mixture is formed to the required shape and is set by reaction of the modified polyisocyanate with the polyhydroxy composition.

2. A method according to claim 1 wherein the polyisocyanate is heated with approximately one-third of its weight of the drying oil.

3. A method according to any preceding claim wherein the polyhydroxy composition comprises aromatic hydroxyl groups.

4. A method according to claim 3 wherein the polyhydroxy composition comprises a phenol-formaldehyde reaction product.

5. A method according to claim 3 wherein the polyhydroxy composition comprises bisphenol-A.

6. A method according to any preceding claim wherein the polyhydroxy composition comprises aliphatic hydroxyl groups.

7. A method of producing a foundry mould or core substantially as herein described with reference to the example.

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WHAT WE CLAIM IS:-

1. A method of producing a foundry mould or core wherein a polyisocyanate is modified by reacting some of the isocyanate groups present with a drying oil, the modified polyisocyanate and a polyhydroxy composition are mixed with an aggregate, the mixture is formed to the required shape and is set by reaction of the modified polyisocyanate with the polyhydroxy composition.
2. A method according to claim 1 wherein the polyisocyanate is heated with approximately one-third of its weight of the drying oil.
3. A method according to any preceding claim wherein the polyhydroxy composition comprises aromatic hydroxyl groups.
4. A method according to claim 3 wherein the polyhydroxy composition comprises a phenol-formaldehyde reaction product.
5. A method according to claim 3 wherein the polyhydroxy composition comprises bisphenol-A.
6. A method according to any preceding claim wherein the polyhydroxy composition comprises aliphatic hydroxyl groups.
7. A method of producing a foundry mould or core substantially as herein described with reference to the example.

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