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(54) **METHOD FOR THE PRODUCTION OF INSULATION PLATES AND BINDING AGENT MIXTURE FOR SAME**

(75) Inventor: **Josef Suren**, Bad Wunnenberg-Haaren (DE)

Correspondence Address:
Charles A. Muserlian
c/o Hedman and Costigan
1185 Avenue of the Americas
New York, NY 10036 (US)

(73) Assignee: **Bakelite AG**

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(57) **ABSTRACT**

A method for the production of insulation plates from an aqueous pulp comprised of mineral fillers, cellulose-containing products and a binding agent based on a novolak wherein a pulp is used comprising an additive substance selected from the group consisting of fatty acid amides or substituted fatty acid amides, the plates obtained after curing are used, inter alia, as mold covering plates or as so-called tundish plates for application in continuous casting processes.

METHOD FOR THE PRODUCTION OF INSULATION PLATES AND BINDING AGENT MIXTURE FOR SAME

[0001] The invention relates to a method for the production of refractory insulation plates comprised of mineral fillers, cellulose-containing products and a thermosetting binding agent.

STATE OF THE ART

[0002] Such plates are employed, inter alia, as mold covering plates or as so-called tundish plates in continuous casting processes. They are produced by heating and curing a mixture preformed into the corresponding plate form, which is produced by removing water from an aqueous pulp comprised of cellulose-containing products, mineral fillers and a thermosetting binding agent. For this purpose, the pulp is poured onto a fine screen and the water is extracted under vacuum, but this process step is highly time-consuming and a need exists to shorten it.

[0003] The conventionally employed thermosetting binding agent is a mixture of a novolak and a curing agent, wherein a relatively highly condensed product must be used having an average molecular weight of 800 to 900 and a flow distance of approximately 20 to 30 mm as the novolak. With these novolaks, however, only moderate strengths of the insulation plates are attained. An improvement of the strength values results if novolaks with lower average molecular weights or greater flow distances are used. However, these binding agents swell more strongly in the pulp and thereby, the water extraction times are drastically increased, so that the use of these resins is not suitable for reasons of economy.

OBJECTS OF THE INVENTION

[0004] It is an object of the invention to provide a method for the production of insulation plates, which, in principle, corresponds to the method conventionally used until now, but in which the water extraction times are shortened.

[0005] It is another object of the invention to provide a method with which insulation plates of high strength can be produced without the water extraction time being increased.

[0006] These and other objects and advantages of the invention will become obvious from the following detailed description.

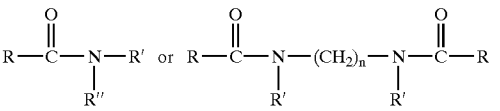
THE INVENTION

[0007] The novel resin mixture of the invention is derived by pulverizing a solidified melt of a novolak and as an additive, at least one member selected from the group consisting of fatty acid amides and substituted fatty acid amides.

[0008] The improved method of the invention to produce insulation plates comprises forming a resin powder of a solidified melt of a novolak and at least one additive selected from the group consisting of fatty acid amides and substituted fatty amides, forming an aqueous pulp of said resin powder, cellulose containing products and mineral fillers, pouring the aqueous pulp onto a fine-mesh flat screen and extracting the water under vacuum to obtain a "green" filter cake plate and curing the plate at a temperature of at least 120° C., preferably 150° C.

[0009] By employing an aqueous pulp comprised of cellulose-containing products, mineral fillers and novolak, which additionally contain at least one product selected from the group consisting of fatty acid amides or substituted fatty acid amides, the water extraction times are significantly shortened. The strength of the plates produced from these mixtures is not impaired by this addition. It was further found that these additives from the group of fatty acid amides or substituted fatty acid amides make it possible to use novolaks with lower average molecular weight, i.e. with greater flow distance, without the water extraction time being lengthened. Therefore, insulation plates are obtained whose strengths are 30% higher than those produced by prior art methods.

[0010] The fatty acid amides and the substituted fatty acid amides are solid or semisolid compounds of the formulae



wherein R is optionally branched alkyl of 10 to 30 carbon atoms, R' and R" are individually hydrogen or alkyl of 1 to 6 carbon atoms and n is an integer of 1 to 6. Preferred compounds are oleamide, behenamide, stearamide and, more preferably, bisstearamide. These compounds are known from Chem. Ab. 129:55251 as parting compounds in epoxy resin or phenolic resin formulations.

[0011] Binding agents comprised of phenolic resin in combination with substituted and unsubstituted fatty acid amides are described as binding agents for sand in the production of molds in the field of casting [JP-A 60111734 (C.A. 103:182359) or JP-A 57209741 (C.A. 98:165573]. A study regarding the effect of additive substances onto the flow and curing behavior of phenolic resin molding compounds (C.A. 104:34743) found that, with increasing content of mold release compounds, the flow behavior is improved, but also that with increasing quantity of, for example, ethylene bisstearyl amide, the full depth-curing rate is impaired. A person skilled in the art would thus expect that the strength of the resulting products is also decreased.

[0012] In the method of the invention, the products from the group of fatty acid amides or substituted fatty acid amides are added in amounts of 1 to 10 wt. %, preferably of 3 to 5 wt. %, relative to the amount of the resin of the thermosetting binding agent. The addition preferably takes place to the novolak.

[0013] It was found that the strength of the insulation plates is improved and that the water extraction times are significantly shortened if the additive substances from the group of fatty acid amides or substituted fatty acid amides are not only mixed with the powdered resin, but rather if they are melted together with this resin and the resulting mixture is pulverized after solidification. Consequently, a new powdered resin mixture is obtained, produced by melting a thermosetting resin with an additive substance selected from the group consisting of fatty acid amides or substituted fatty acid amides and pulverization of the solidified melt.

[0014] This powdered resin mixture can then be mixed with the curing agent for the novolak and, optionally, it can

as well be mixed with further fillers and additives. Thus, the binding agent mixture for carrying out the method of the invention is generated. The preferred latent curing agent for the novolaks is hexamethylene tetramine, which is mixed into the novolak, or into the powdered resin mixture of novolak and the additive substance of fatty acid amides or substituted fatty acid amides, in amounts of 3 to 6 wt. % relative to the weight of the novolak.

[0015] Examples of novolaks are all condensation products of phenolic compounds and an aldehyde, particularly, formaldehyde, which can be produced in an acidic medium in a molar ratio of phenolic compound to aldehyde of 1:0.9 to 1:0.2, and having a melting point of 50 to 110° C. In order to work carefully, mixtures of novolaks can be used which have a lower and a higher melting point. The preferred novolaks have an average molecular weight of 500 to 800, preferably 600 to 750, or a flow distance in the range of 35 to 55 mm. The amounts of the employed novolaks are in the range of 1 to 10 wt. % relative to the total dry mixture.

[0016] Examples of phenolic compounds are mono- or polynuclear phenols or mixture of the named compound classes and specifically mono- as well as polynuclear phenols. Examples of these are phenol itself, its alkyl-substituted homologues, such as o-, m- or p-cresol, xylols or higher alkylated phenols, as well as polyvalent phenols such as resorcinol or purocatechol, and polynuclear phenols such as naphthols, bisphenol A or bisphenol F.

[0017] Phenol or the phenolic compound or mixtures of phenolic compounds are reacted with aldehyde, preferably with formaldehyde or a compound splitting off formaldehyde to form the desired novolak. The novolaks can be modified with conventional modification means, such as, epoxy resins, raw rubber, polyvinyl butyral and inorganic additive substances.

[0018] The composition of the corresponding mixtures for the production of the insulation plates with respect to the composition of the individual components as well as also with respect to their quantities corresponds to those of the mixtures conventionally used and known for this purpose. As mineral fillers can be employed all fillers conventionally employed in the refractory industry. Preferred are silicon dioxide, magnesium and aluminum oxide, magnesite, bauxite or andalusite and their mixtures in any desired mixing ratios.

[0019] Examples of cellulose-containing products include, in principle, all small-particle, cellulose-containing raw materials, such as cellulose fibers, wood fibers, wood shavings, wood powder or mechanical wood pulp, but preferably shredded paper.

[0020] The individual components are mixed with one another in any sequence desired per se and mixed with water and processed in a manner known per se into pulp, which subsequently under shaping is poured onto a fine-mesh flat screen and water is extracted under vacuum therefrom. The "green" plate obtained as filter cake is subsequently cured at temperatures above 120° C., preferably above 150° C.

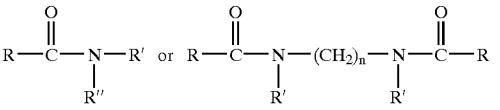
[0021] Various modifications of the compositions and process of the invention may be made without departing from the spirit or scope thereof and it should be understood that the invention is intended to be limited only as defined in the appended claims.

1-8. (canceled)

9. A process for the production of insulation plates comprising forming an aqueous pulp comprised of cellulose containing products, mineral fillers and a novolac binding agent, probing the aqueous pulp onto a fine-mesh screen, extracting the water from the pulp under vacuum to obtain a "green" filter cake plate and curing the plate at a temperature of at least 120° C., the improvement comprising adding to the pulp at least one additive selected from the group consisting of fatty acid amides and substituted fatty acid amides.

10. The process of claim 9 wherein the resin mixture of claim **1** is used.

11. The process of claim 9 wherein the additive has the formula



wherein R is alkyl of 10 to 30 carbon atoms, R' and R" are individually hydrogen or alkyl of 1 to 6 carbon atoms and n is an integer from 1 to 6.

12. The process of claim 9 wherein the additive is selected from the group consisting of oleamide, behenamide, stearamide, and bisstearamide.

13. The process of claim 9 wherein the additive is bisstearamide.

14. The process of claim 9 wherein the novolac has an average molecular weight of 500 to 800.

15. The process of claim 9 wherein the novolac has an average molecular weight of 600 to 750.

16. An insulation plate formed by the process of claim 9.

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