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(54) Moulding or core sand bonded by biodegradable polymeric binder

(57) Moulding or core sand bonded by a biodegradable polymeric binder made of one hundred parts by weight of refractory matrix as well as of one up to five parts by weight of organic binder is characterized by the binder containing a mixture of aqueous solution of synthetic polymer in the quantity of 30 - 70% by weight and natural polymer in the quantity of 30-70% by weight.

The applied synthetic polymer is poly(acrylic acid) or poly(sodium acrylate). The natural polymer effectively applied is a biopolymer of polysaccharide group in the form of modified starch or dextrin.

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Description

[0001] The subject-matter of the invention is moulding or core sand bonded by a biodegradable polymeric binder finding application in foundry engineering.

[0002] Moulding or core sand as well as its hardening method are known from Polish patent specifications Nº 207459. The sand consists of one hundred parts by weight of a refractory matrix and of one up to five parts by weight of binder. The binder contains polyacrylate, which is obtained as a result of neutralization of poly (acrylic acid) polymer with 20 - 60% aqueous solution of a potassium or sodium base, determining a pH value of 6 - 10, and it also contains photoinitiator additive in the quantity of 0-1% by weight of the photoinitiator in relation to the quantity of binder. The hardening of the sand takes place through electromagnetic wave interaction; moulds or cores are subjected to the reaction of binder, which occurs by applying microwaves or ultraviolet radiation. Moreover, the publication of international patent application WO2009/065015 contained the composition of the moulding sand, including the refractory matrix and the binder, made of polymerizable components in the form of hydrolyzed carbohydrates, of components containing isocyanate and of a polymerization amine catalyst.

[0003] Moulding or core sand bonded by a biodegradable polymeric binder made of one hundred parts by weight of refractory matrix as well as of one up to five parts by weight of organic binder is characterized by the binder containing a mixture of aqueous solution of synthetic polymer in the quantity of 30-70% by weight and natural polymer in the quantity of 30-70% by weight.

[0004] The synthetic polymer applied is poly(acrylic acid) or poly(sodium acrylate). As a natural polymer it is effectively applied to biopolymer of polysaccharide group in the form of modified starch or dextrin.

[0005] The foundry moulds or cores made out of sand in the above-mentioned composition are subjected to the crosslinking process of the binder, which occurs by applying microwaves or increasing the temperature.

[0006] According to patent specifications the sands are easy to knock out of the castings and water-soluble biopolymer contained in them because of binder biodegradability enabling the deposition of moulding sands, and because of binder reactivity, which by hardening enables with the action of the physical agent. In addition, used sands which didn't undergo a complete burnout may be subjected to rebonding, which makes it easy to recycle it. The sands are characterized by increased susceptibility to mechanical and thermal reclamation, as well. Moreover, the foundry moulds and casting cores obtained ensure high microstructure homogeneity, mechanical, useful and corrosive properties in the full section of casting and also a good quality of their surface. The castings are flawless such as: pitting, surface roughness, gaseous porosity or graphite deformation in the near-surface layer. The moulding sand is characterized by minimal harmfulness to workers and for the natural environment.

[0007] Example I. The moulding sand consists of one hundred parts by weight of silica sand as well as of three parts by weight of binder which contains 30% of aqueous solution liquor of poly(acrylic acid) in the quantity of 50% by weight and 40% aqueous solution liquor of dextrin in the quantity of 50% by weight. Poly(acrylic acid) is characterized by the following parameters: mass-average relative molecular mass M_w = 100,000 g/mol, pH = 1.5 and Brookfield viscosity = 1,000 mPa·s. The foundry mould made out of this sand was placed in the field of action of microwaves with a power of 800 Watts for 90 seconds. After hardening the mass of compressive strength R^u_c = 2.5 MPa and of bending strength R^u_g = 1.5 MPa the final result is achieved after 24 hours of storage.

[0008] Example II. The core sand consists of one hundred parts by weight of silica sand as well as of three parts by weight of binder which contains 40% aqueous solution of poly(sodium acrylate) in the quantity of 70% by weight and 40% aqueous solution of dextrin in the quantity of 30% by weight. Poly(sodium acrylate) is characterized by the following parameters: mass-average relative molecular mass M_w = 250,000 g/mol, pH = 9 and Brookfield viscosity = 5,000 mPa·s. The core made out of this sand was placed in a warming system at a temperature of 150°C and it was stored for 120 minutes. After hardening the mass of compressive strength R^u_c = 2 MPa and of bending strength R^u_g = 1.1 MPa, the final result is achieved after 24 hours of storage.

[0009] Example III. The moulding sand consists of one hundred parts by weight of silica sand as well as of three parts by weight of binder which contains 30% aqueous solution of poly(acrylic acid) in the quantity of 50% by weight and 10% aqueous solution of modified starch in the form of carboxymethyl starch in the quantity of 50% by weight. Poly(acrylic acid) is characterized by the following parameters: mass-average relative molecular mass M_w = 100,000 g/mol, pH = 1.5 and Brookfield viscosity = 1,000 mPa·s. The foundry mould made out of this sand was placed in a warming system at a temperature of 150°C and it was stored for 120 minutes. After hardening the mass of compressive strength R^u_c = 1.8 MPa and of bending strength R^u_g = 1 MPa the final result is achieved after 24 hours of storage.

Claims

1. Moulding or core sand bonded by a biodegradable polymeric binder made of one hundred parts by weight of refractory matrix as well as of one up to five parts by weight of organic binder is **characterized by** the binder containing a mixture of aqueous solution of synthetic polymer in the quantity of 30 - 70% by weight and natural polymer in the quantity of 30 - 70% by weight.

2. According to patent claim 1, the sand is marked with

the applied synthetic polymer, poly(acrylic acid) or poly(sodium acrylate).

3. According to patent claim 1, the applied natural polymer is a biopolymer of polysaccharide group in the form of modified starch or dextrin.

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EUROPEAN SEARCH REPORT

Application Number
EP 12 46 0051

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	BEATA GRABOWSKA ET AL: "Biodegradation of New Polymer Foundry Binders for the Example of the Composition Polyacrylic Acid/Starch", ARCHIVES OF FOUNDRY ENGINEERING, vol. 11, no. 2, 30 April 2011 (2011-04-30) , pages 65-70, XP055050220, ISSN: 1987-3310 * paragraph [2.1.Biodegradationexaminations] * * paragraph [3.Biodegradation...in.water...] * * paragraph [4.Biodegradation...in.a.soil] * * paragraph [5.Conclusions] *	1-3	INV. B22C1/22 B22C1/26
A	JP 11 138234 A (GUNEI KAGAKU KOGYO KK) 25 May 1999 (1999-05-25) * abstract *	1-3	
A	GB 1 007 360 A (MO OCH DOMSJOE AB) 13 October 1965 (1965-10-13) * page 1, lines 8-54 *	1-3	TECHNICAL FIELDS SEARCHED (IPC) B22C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	21 January 2013	Lombois, Thierry

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

1 EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 46 0051

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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21-01-2013

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 11138234 A	25-05-1999	NONE	
GB 1007360 A	13-10-1965	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- PL 207459 **[0002]**
- WO 2009065015 A **[0002]**