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(54) **CARBONACOUS MATERIAL ADDITIVE FOR REDUCING EMISSIONS AND IMPROVING SAND ADHERENCE**

(57) A carbonaceous additive for a moulding material for casting iron, wherein the carbonaceous additive comprises coke in an amount of 25 % by weight of the carbonaceous material or more, but less than 50 % by weight of the carbonaceous material, pit coal in an amount of 45 % by weight of the carbonaceous material or more,

but less than 65 % by weight of the carbonaceous material, and optionally coal dust replacement in an amount of 20 % by weight of the carbonaceous material or less, and in that the amount of pit coal is greater than the amount of coke.

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Description

Technical field

[0001] The present invention relates to a carbonaceous material additive for a moulding material and a method for casting iron, the carbonaceous material comprising pit coal and coke.

[0002] More particularly, the present disclosure relates to a carbonaceous material additive for reducing emissions during the casting process and sand adherence or sand sticking to the iron work piece.

Background

[0003] In the casting of iron in green sand moulds, it is known to form a moulding material that contains about 80-90% by weight of sand, about 5-11 % by weight of binder (usually bentonite), about 3-4% by weight of water and about 2-6% by weight of carbonaceous material, these are conventionally called clay-bonded sand moulds.

[0004] In commercially used moulding materials, the carbonaceous material consists mainly of powdered coal, or alternatively a coal dust replacement. A problem associated with this kind of carbonaceous material is that it contains a certain amount, usually about 30% by weight, of volatile compounds (such as VOC - volatile organic compounds), which are set free as the moulding material is heated, and which cause emissions and problems with odour from the foundry plant. However, these volatile organic compounds have a beneficial effect on the casting performance by reducing the adherence of, for example, the moulding material to the cast object, thus reducing the amount of moulding sand that has to be removed from the cast object in subsequent production stages.

[0005] A carbonaceous additive for moulding materials is known from EP1800771A1. Further experience has shown that this additive works well for smaller work pieces, such as work pieces having a mass of 10 kg or less, or having a maximum wall thickness of 20 mm or less. In particular, this additive provides a very good trade-off between VOC emission and sand adhesion.

[0006] However, for larger work pieces, while the VOC emission remains low, the sand adhesion has turned out to be greater than what is desirable. Hence, there is a need for a carbonaceous additive which is suitable for larger work pieces.

Summary

[0007] It is an object of the present disclosure, to provide an improved carbonaceous material or additive for a moulding material for casting iron which eliminates or alleviates the disadvantages of the prior art foundry sand.

[0008] More specific objects include providing a carbonaceous material or additive for casting iron providing

reduced and acceptable level of emissions of volatile organic compounds (VOC) while still giving an acceptable sand adherence to the work pieces molded in the foundry sand.

[0009] The invention is defined by the appended independent claims. Embodiments are set forth in the appended dependent claims and in the following description.

[0010] According to a first aspect there is provided a carbonaceous additive for a moulding material for casting iron, wherein the carbonaceous additive comprises coke in an amount of 25 % by weight of the carbonaceous material or more, but less than 50 % by weight of the carbonaceous material, pit coal in an amount of 45 % by weight of the carbonaceous material or more, but less than 65 % by weight of the carbonaceous material, and optionally coal dust replacement in an amount of 20 % by weight of the carbonaceous material or less, and in that the amount of pit coal is greater than the amount of coke.

[0011] This additive has proven to be surprisingly effective and applicable in casting larger work pieces, i.e. pieces having a weight of at least 10 kg, while still providing both acceptable VOC emissions and an acceptable sand adherence to the work piece.

[0012] The amount of coke may be 35-45 % by weight of the carbonaceous material and the amount of pit coal is 55-65 % by weight of the carbonaceous material.

[0013] The amount of coal dust replacement may be less than 10 % by weight, preferably less than 5 % by weight or less than 2 % by weight.

[0014] Coal dust replacement may for instance be used to enhance the surface finish of the product, but does not generally contribute to the lowering of VOC emissions or the sand adherence.

[0015] The coal dust replacement may be selected from a group consisting of carbon containing material such as pyrolytic or lustrous carbon former in solid or liquid form such as asphalt, gilsonite, petroleum distillates, organic polymers, dextrin, and starch.

[0016] According to a second aspect there is provided the use of an additive according to the first aspect, in a process of casting a part of iron having a mass of 10 kg or more, preferably 20 kg or more, 50 kg or more or 100 kg or more.

[0017] According to a third aspect there is provided the use of an additive according to the first aspect in a process of casting a part of iron having a smallest wall thickness of 10 mm or more, or preferably 20 mm or more.

[0018] According to a fourth aspect there is provided a moulding material comprising:

sand in an amount of 80-95 % by weight of the moulding material,

binder in an amount of 4-15 % by weight of the moulding material, and

the additive according to the first aspect in an amount of 0.5-10 % by weight of the moulding material.

[0019] The additive may be added in an amount providing a carbon content in the range of 1.5 to 4 % by weight of the moulding material.

[0020] By carbon content is thus meant the measured carbon content in the moulding material, a measurement which is routinely performed in a foundry, usually before every casting cycle to ensure a reproducible result of the casting and the quality of the casting. The amount of additive needed in the moulding material will be dependent on factors such as for instance sand to metal ratio. The skilled person would be able to recognize this and know how to calculate an appropriate addition of the carbonaceous material additive.

Description of Embodiments

[0021] The carbonaceous material additive according to the invention comprises coke in an amount of 25 % by weight of the carbonaceous material or more, but less than 50 % by weight of the carbonaceous material, pit coal in an amount of 45 % by weight of the carbonaceous material or more, but less than 65 % by weight of the carbonaceous material. The amount of pit coal is thus greater than the amount of coke in the carbonaceous material additive.

[0022] The amount of coke may be 35-45 % by weight of the carbonaceous material and the amount of pit coal is 55-65 % by weight of the carbonaceous material.

[0023] By pit coal is also meant powdered coal, or coal dust. Pit coal in this respect may also be called sea coal, or be of similar types of coal that comprises around 30 % volatile organic compounds.

[0024] In EP1800771A1 it was shown that a conventional foundry sand having mainly pit coal/coal dust replacement as the carbonaceous material gave very high emissions of VOCs, but also exhibited very low sand sticking (see sample 3 of EP1800771A1). In contrast a foundry sand where the carbonaceous material consisted of only coke, gave very low VOC emissions, but on the other hand high amount of sand sticking (see sample 1 of EP1800771A1). In EP1800771A1 it was further proved that a carbonaceous material comprising powdered pit coal and coke, with coke as the main constituent of the carbonaceous material, gave not only reduced VOC emissions, but also an acceptable level of sand sticking or sand adherence. The carbonaceous material additive as disclosed in EP1800771A1 has showed to be in particular efficient for smaller work pieces.

[0025] The present document discloses an inventive carbonaceous material additive that is particularly suitable for larger work pieces. It may thus be used in a process of casting a part of iron having a mass of 10 kg or more, preferably 20 kg or more, 50 kg or more or 100 kg or more and in a process of casting a part of iron having a smallest wall thickness of 10 mm or more, or preferably 20 mm or more.

[0026] The carbonaceous material may be added to the foundry sand or material in a range from 0.5 to 10 %

by weight of the foundry sand.

[0027] The carbonaceous material additive may be added to the foundry sand or material giving a measured carbon content in a range from 1.5 to 4 % by weight of the foundry material or sand.

[0028] In this respect the difference between the expressions "carbonaceous material", which is the material that is added to the foundry sand mixture and the "carbon content", which is a measured value of the total carbon content in the foundry sand mixture is to be noted.

[0029] The carbonaceous material may also comprise coal dust replacement, preferably in an amount of 20 % by weight of the carbonaceous material or less. The amount of coal dust replacement may be less than 10 % by weight, preferably less than 5 % by weight or less than 2 % by weight. The coal dust replacement may be selected from a group consisting of carbon containing material such as pyrolytic or lustrous carbon former in solid or liquid form such as asphalt, gilsonite, petroleum distillates, organic polymers, dextrin, and starch. The organic polymer may be for instance polystyrene.

Trial

[0030] The carbonaceous additive according to the invention was tested in an actual foundry for industrial manufacture of cast iron. Iron engine blocks, i.e. work pieces having a weight of more than 10 kg, and a minimum wall thickness of 10 mm or more, were casted in a trial to test the possible reduction in emissions by using the additive, and how the additive affected the sand sticking or sand adherence to the work piece, i.e. if the additive could be used in a production effective manner.

[0031] The carbonaceous additive was added to the moulding material or foundry sand to give measured carbon content in the moulding material of around 1.5 to 4 % by weight.

[0032] The measurement if the carbon content in the moulding material or foundry sand is well-known to the skilled person and routinely performed before each new casting cycle. If the carbon content is too low more carbonaceous material will have to be added.

[0033] The carbonaceous material added to the foundry sand comprised 40 % by weight of the carbonaceous material coke, and 60 % by weight of the carbonaceous material pit coal or powdered (pit) coal.

[0034] The carbonaceous material was added to the foundry sand in a range of from 0.5 to 10 % by weight of the foundry sand. The amount added will be dependent on the desired and/or measured carbon content of the foundry sand, and will vary from foundry to foundry, and be dependent on the type of work piece that is to be casted.

[0035] A mould was made from the mixture of the carbonaceous material and the moulding material. The emissions and smoke from the casting process were led off via a ventilation duct, where the VOC emissions were measured.

[0036] The VOC can be measured using different types of measurement methods known to the skilled person. One such method is by using FID instruments (gas chromatography with flame ionization detector) or by using so called Tenax ® tubes followed by analysis with gas chromatography and mass spectrometry (GC-MS). The FID instruments measures the total VOC emission, including methane. Tenax tubes may further allow for analysis of the various hydrocarbons except for the lightest such as methane and can be used as a complement in a measuring process.

[0037] In the above described casting process FID measurements were taken continually during the entire casting period, i.e. during casting, cooling and shale-out. All of the samples were taken from the ventilation duct.

[0038] The values of the VOC emission from the casting process using the inventive carbonaceous material was compared to VOC emissions when using a conventional carbonaceous material, such as powdered coal, i.e. powdered pit coal.

[0039] The trial clearly show that VOC emissions have been reduced for when using the additive compared to a conventional pit coal additive, i.e. the inventive carbonaceous material additive yields much lower VOC emission than conventional pit or sea coal dust or powdered coal.

[0040] When these products and additives are introduced in foundry production, it is standard practice to start with a combination of ordinary carbonaceous material additives and the inventive additive. The usual proportion of the latter is approximately 50%, which is then gradually increased. VOC emissions are thereby reduced to a corresponding degree.

[0041] The measured VOC emissions in the above described trial were ultimately reduced by up to 50 % by using the inventive carbonaceous material additive, while still giving an acceptable sand adherence and thus good working efficiency of the foundry sand.

Claims

1. A carbonaceous additive for a moulding material for casting iron,
characterized in that
the carbonaceous additive comprises coke in an amount of 25 % by weight of the carbonaceous material or more, but less than 50 % by weight of the carbonaceous material, pit coal in an amount of 45 % by weight of the carbonaceous material or more, but less than 65 % by weight of the carbonaceous material, and optionally coal dust replacement in an amount of 20 % by weight of the carbonaceous material or less, and **in that** the amount of pit coal is greater than the amount of coke.
2. The additive as claimed in claim 1, wherein the amount of coke is 35-45 % by weight of the carbon-

aceous material and the amount of pit coal is 55-65 % by weight of the carbonaceous material.

3. The additive as claimed in claim 1 or 2, wherein the amount of coal dust replacement is less than 10 % by weight, preferably less than 5 % by weight or less than 2 % by weight.
4. The additive as claimed in any one of the preceding claims, wherein the coal dust replacement is selected from a group consisting of carbon containing material such as pyrolytic or lustrous carbon former in solid or liquid form such as asphalt, gilsonite, petroleum distillates, organic polymers, dextrin, and starch.
5. Use of an additive as claimed in any one of claims 1 to 4, in a process of casting a part of iron having a mass of 10 kg or more, preferably 20 kg or more, 50 kg or more or 100 kg or more.
6. Use of an additive as claimed in any one of claims 1-4, in a process of casting a part of iron having a smallest wall thickness of 10 mm or more, or preferably 20 mm or more.
7. A moulding material comprising:
sand in an amount of 80-95 % by weight of the moulding material,
binder in an amount of 4-15 % by weight of the moulding material, and
the additive as claimed in any one of claims 1-4 in an amount of 0.5-10 % by weight of the moulding material.
8. The moulding material as claimed in claim 7, wherein the additive is added in an amount providing a carbon content in the range of 1.5 to 4 % by weight of the moulding material.



EUROPEAN SEARCH REPORT

Application Number
EP 17 15 5559

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 13 June 2017	Examiner Grave, Christian
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	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 17 15 5559

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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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13-06-2017

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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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