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RESEARCH REGARDING THE RE-UTILIZATION OF MOLDING SANDS PREPARED WITH SYNTHETIC RESINS WITHOUT ANY COMPLEX RECLAIM OPERATIONS

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ABSTRACT: *There is poor information in the literature written on this theme, regarding the re-utilization without regenerating operations of the molding sands prepared with synthetic resins. In practice, these methods have a lot of difficulties regarding the separation of molding sands with organically bonding agents compared with the sands prepared with non-organically agents. The re-utilization of molding sands based on resins without technological regenerating processes is not to be applied in the practice of the preparation with resins. Therefore is intended a re-utilization of these molding sands, with non-organically bonding agents (bentonite), replacing thus, partly, with new sand. The industrial foundry practice showed that this method could be applied with good results to any type of mould based on the organically bonding agents.*
KEYWORDS: *foundry processes, re-utilization, reclaim operations, molding sands, synthetic resins, non-organically bonding agents (bentonite)*

INTRODUCTION – THE RESEARCH AREA

In the specialty literature there are just a few articles regarding the re-utilization without reclamation of molding sands with synthetic-resins. This situation cannot be explained through the hardships regarding the separation of the molding sand with organic binder from the molding sand with inorganic binder, because all the references regarding the thermal reclamation processes confirm that the two qualities of molding sand are separable at rapping.

Two general types of binder systems are used in metal casting: clay-bonded systems (green sand) and chemically-bonded systems (resin sands). Both types of sands are suitable for recycling and beneficial use but they have different physical and environmental characteristics.

In modern foundry practice, sand is typically recycled and reused through many production cycles. It is standard foundry practice to reuse molding sands. Residual sand is routinely screened and returned to the system for reuse. The processes for recycling waste foundry sand are divided between regeneration and beneficial reuse, and the potential for regeneration is higher than that of reuse.

Reuse and reclamation of molding sands with synthetic-resins have long been of interest because of their unique characteristics in both bonding mechanism and high temperature strength, which make them ideal for applications in cast production. Usually, the used sands can be reclaimed as support sands after dry treatment or reconditioning, but for use as face sands wet reclamation is necessary. To adopt some complex reclamation installations, used for all kinds of molding and core sands, in our foundries with medium modernization and partially mechanized, would be conditioned by the economical and financial problems.

From these aspects we can start any calculus regarding the efficiency and profitability in foundries, this being precisely the reason that experts in these arias try, in any way, to utilize and re-utilize all the starting materials they have, in order to obtain the highest efficiency for the installations, equipments and aggregates existing in foundries, with a minimal financial effort and without decreasing the quality of cast pieces.

The re-utilization of molding sand prepared with organic binder, especially with synthetic resins, without any reclamation operation, is not particularly used in practice for a new resins molding preparation. For these reason it is attempted, in our foundries, as a new technological method, the re-utilization of these molding sands, using the inorganic binders (clay, bentonite and/or sodium silicate) instead of the synthetic resins. Practically, it is attempted to obtain a sample of molding sands re-used with synthetic resins and an inorganic binder, the molding used replacing the new sand from the composition of the freshly prepared mixture.

PRESENTATION OF THE WORKING METHOD

The most common flaws in foundries are adhesions that occur in the ferrous alloys pieces, which require more manual labor in the cleaning sectors for their removal. In order to prevent adhesion

appearances, especially the chemical ones, predominantly at the steel pieces cast, there are two technological possibilities:

- *To add, at the preparation of the molding sand, some materials that create a decreasing atmosphere at the metal – mould contact surface, in this way preventing the formation of basic oxide in liquid metal or even the reduction of the already formed oxides. As a reduction material one can use coal.*
- *To use some basic refractory or neutral materials in the sample molding sand, materials that don't interact with the basic oxides from the cast liquid alloy.*

Foundries make considerable investments for the quality control of their sand systems with rigorous testing done to ensure consistency. Due to the fact that basic refractory materials are more expensive, their purchase by the foundries is only a technology foresight for the future. In these conditions, the first method remains as a possibility to avoid the appearance of adhesion, explicitly the utilization in the prepared moldings of the organic materials that produce a film with reduction gases at the metal – mould contact surface.

THE EXPERIMENTAL RESEARCH

In the performed researches used molding sands, binders with synthetic formaldehyde resins were utilized. Such molding sand has in its composition, if it is well sorted, only acid refractory material (SiO_2) and a quantity of synthetic resin that didn't burn during the previous cast, but it is still sufficient to produce the reduction gas film. It can be stated that the used molding with synthetic resins has a superior quality than the new sand, because the used mould also contains the organic material necessary to produce the reduction gas film.

Permeability and compression strength were the important characteristics of green sand. In this paper are presented the data regarding the laboratory experiments performed in order to realize this study, as well as a series of graphic representations of the permeability of the analyzed molding sands. Also, tests were done in order to determine the compression resistance of the molding sands bound with various bentonite percentages. The tests take into consideration the various degrees of the humidity for the laboratory prepared molding sands.

Research were done regarding the re-utilization of molding sand with synthetic resins, adding as a binder organic materials such as bentonite, witch is classic binders and are normally found in any of our foundries. As a result of the experimentation, in addition to the identification of optimum levels for the ingredients, the proportion of bentonite was defined. This was leading to a large financial benefit for the foundry. All operations are realized with the equipment already existing in the foundry, regardless of the mechanization level.

RESULTS AND DISCUSSIONS

The experiments were performed with granular material (sand) resulted from crushed moulds (mechanically degraded) during the molding-assembly process, that didn't enter in the casting process due to the degradation. In this way the mould sands contained the entire quantity of binder. With the sand resulted after the crushing of the moulds in the mixer a sample mixture has been prepared, for green (undried) and dry moulds. As a binder, the bentonite was used, in order to observe the technological properties, in comparison with those obtained with the same granular material, but bound with clay.

In order to know the influence of the bentonite quantity over the mould sand properties, several mixtures were prepared, for witch the bentonite content has been increased. In this manner, experimental mixtures with 6%, 10%, 14% and 18% bentonite were prepared. For every different content of bentonite tests were performed, with 3…15% water.

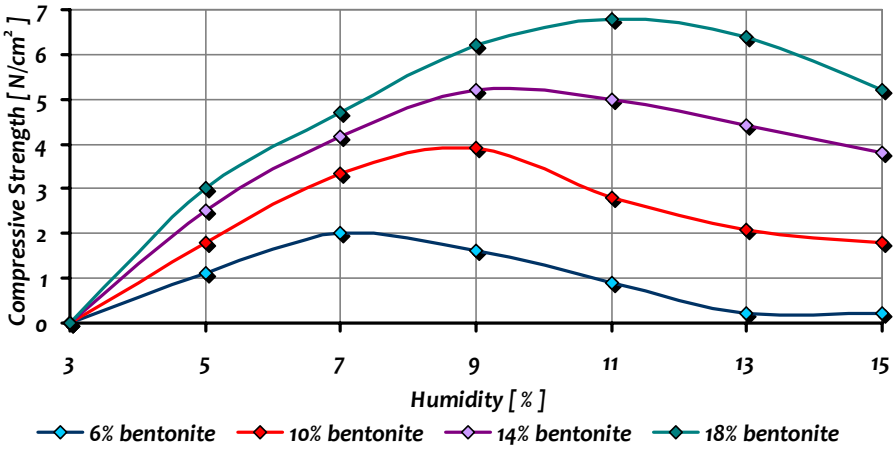

Figure 1. The compression resistance variation with the humidity in the green (undried) mould sands, based on granular material (mechanically degraded before casting) and 6%, 10%, 14% and 18% bentonite

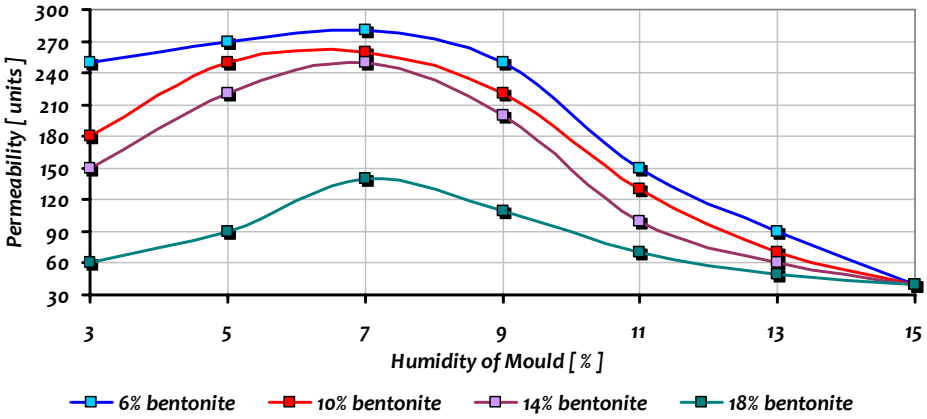

Figure 2. The permeability variation with the humidity of the green (undried) mould sands, based on granular material (mechanically degraded before casting) and 6%, 10%, 14% and 18% bentonite

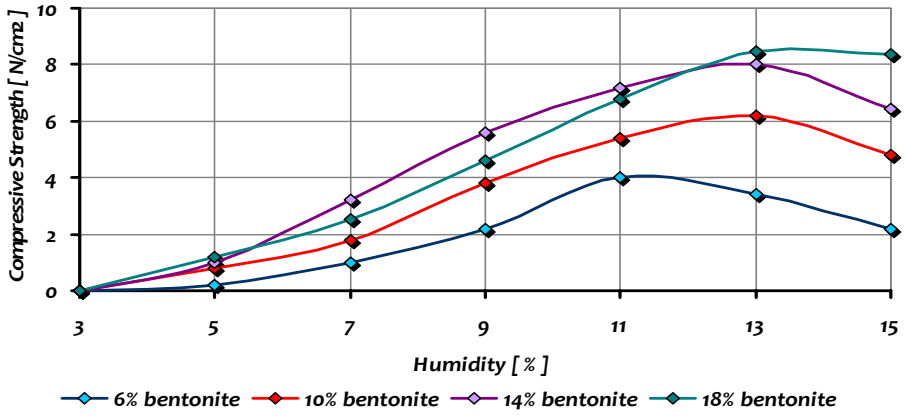

Figure 3. The compression resistance variation with the humidity in dry moulds based on granular material (mechanically degraded before casting) and 6%, 10%, 14% and 18% bentonite

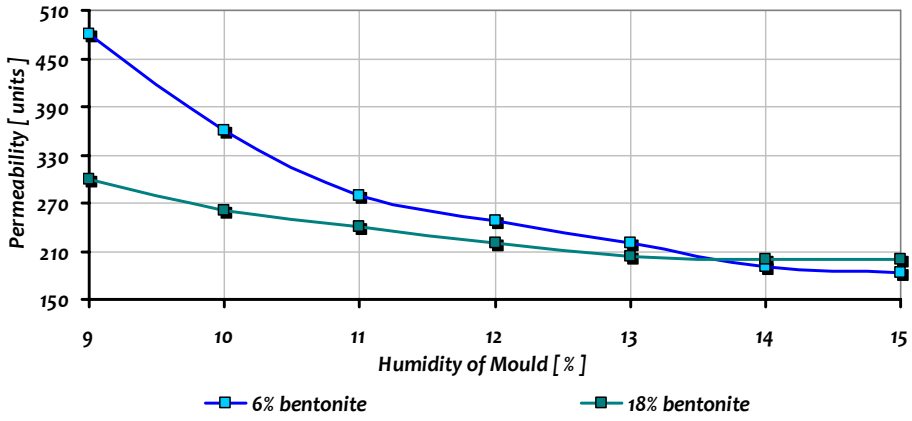

Figure 4. The permeability variation with the humidity of the dry moulds based on granular material (mechanically degraded before casting) and 6% and 18% bentonite

The results achieved over the green (undried) mould sands, based on granular material obtained from crushed moulds (mechanically degraded before casting) and bentonite as a binder, are rendered in Figure 1 and Figure 2. From the analyses of the curves drawn in these diagrams, it can be observed that the mould sands with 6%, 10%, 14% and 18% bentonite have both compression resistance, as well as a good permeability.

The variations of the compression resistance and permeability for similar bentonite mixtures, but in dry moulds, are rendered in Figure 3 and Figure 4. From the analyses of these curves it can be observed that the mould sands bound with bentonite destined for dry moulds ensure both high mechanical resistance, as well as a good permeability.

CONCLUSIONS REGARDING THE RESULTS

The results showed consistent sand properties and casting quality when applying reused support sands. The obtained results have led to the determination of the optimal values of the above-mentioned parameters. We can conclude the following:

- *The material obtained from moulds with synthetic resins, degraded before casting (that are not introduced in the casting process), as well as the moulds that participated in the casting, served as support for the pieces obtained in this way;*
- *These used mixtures were re-used in the casting processes, without any reclamation operation necessary, only a simple addition of organic binder, in different percentages and at a certain humidity degree, after an initially crushing;*
- *Starting from the economical calculation performed in our foundries, the cost of the studied molding mixture is lower then the one obtained from the mixture based on new sand and inorganic binders;*
- *Researches performed in order to obtain a sample mixture, starting from a mould sand based on synthetic resins and bound with bentonite at the re-utilization, were extremely conclusive regarding the compression resistance, in both green (undried) and dry state;*
- *Results were also conclusive regarding the second characteristic studied – mould sand permeability;*
- *Mould sands, based on granular material obtained fro moulds with synthetic resins, as a basic refractory material and an organic binder (bentonite) can be used as a sample mixture for both green (undried) moulds, as well as for dry moulds for steel, iron and non-ferrous alloys castings.*
- *The good results obtained in the laboratory stage recommended these experimental processes for the industrial practice of the molding sectors from our foundries, as well*
- *The industrial practice proved that the surface of the cast iron pieces in the moulds made from these mixtures is superior to those cast in moulds based on new sand and inorganic binders*
- *Researches regarding the obtaining possibilities of sample mixtures, starting from a mould sand based on synthetic resins and bound with other classic binders (clay or silicate sodium – waterglass) can be made, for the re-utilization without any complex reclaim operations in our foundries.*

All these lead to the successfully implementation in our foundry practices of these molding technologies, without any used mixture reclamation operation necessary.

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