

Experience in forming and core mixtures by Alphasht technology

I. Vasková^{a*}, M. Smolková^b, J. Malik^a, Š. Eperješić^c

^aDepartment of Ferrous Metallurgy and Foundry, Faculty of Metallurgy, TU Košice, Slovakia

^bMetallurg Steel s.r.o., Dubnica nad Váhom, Slovakia

^cPrakovská oceliarska spoločnosť, s.r.o., Prakovce, Slovakia

*Corresponding author. E-mail address: Iveta.Vaskova@TuKe.sk

Received 08.02.2008; accepted in revised form 29.02.2008

Abstract

Chemically bound mixtures have had the evolution effect upon the economical and quality aspects of the foundry operations since their presentation at the market. The higher output and significantly increased production efficiency of moulds and cores has led to the material increase in the quality and profit of the foundries. It can be seen that in last several years the knowledge of bounds based on the organic resins has made enormous advances. The higher strength, improved properties under elevated temperatures, the reduction of the environmental impacts of the organic bounds and at the same time their highly improved regeneration ability ensure that these systems will be still more significant binding systems. The organic binding systems are predominantly being developed recently. The technology Alphasht is ranked among the alkali binding systems. This technology has certain disadvantages – lower strength, speed of hardening – which have been gradually eliminated.

Keywords: Resin; Technology Alphasht; Opening material; Organic binding system; Environmental impact.

1. Introduction

The technology of self-hardening mixtures phenol resin – ester is based on the two-component binding system, where the alkali phenol resin is the binding component. The second part of the system controlling the hardening speed, is ester. The mixture self-hardening is based on the reaction of the alkali resin with the ester. When the Alphasht technology is applied, the mixture is hardened in two stages. In general, stated are the following advantages of this technology in comparison with other technologies: reduced sensitivity to overflow occurrence, reduced sensitivity to bubbles and spurs occurrence, reduced sensitivity to temperature, low sensitivity to the humidity effect, easier dismantling of the cores, casts surface better quality, minimum erosion, easier cleaning of patterns.

Technology Alphasht seems to be a suitable solution for the manufacture of the complicated castings, made of steel and cast iron, from the point of their shape and function, for its indisputably technological advantages in comparison with other ST systems.

2. Description of the approach

The goal of an experiment was to find convenient composition moulding mixtures for method Alphasht, namely composition, that fortresses at curve of individual mixtures following after 24 hours were approximately equivalent. From suitable sorts of mixtures to semi-operation an example type of cast stock in foundry Metallurg Steel, s.r.o., Dubnica nad Vahom .

2.1. Work methodology and materials for research

Mixture composition:

There are these materials, used for experiments: opening materials - Provodín 0 – 36 PR 31, Chromit (JAP Třinec), Dunit (Magnolithe), phenol – resol resin AVENOL NB 460 and hardener CATALYSATOR 4015.

Quantity of sand was constant, quantity of binder was determined for 1,6 ; 1,7 ; 2,0 ; 2,3 ; 2,5 ; 3,0 ; 3,5 to 100 weight portion of opening material. Catalyzer was added in constant ratio, it equals 20 % to 100 weight portion of resin.

Within the frame of reaching goal were they suggested these tests of moulding mixtures :

- humidity setting of moulding mixtures
- degree of workability setting
- hardenable settin
- fortresses at curve setting

2.2. Semi-operation tests

For semi-operation trial was chosen mould „Skrňa“. It is concerned cabinet type light cast, on which during classic method production discovered cracks. Brutto weight of cast stock was 235 kg. Gross weight of cast stock was 102 kg. Besides 2 half-forms produced by AlpHaset method, one core was produced this method, too.

Mixture composition

100 weight portion Provodín 0 – 36 PR
 1,7 weight portion..... resin TPA 70
 0,34 weight portion..... hardeners ACE 1535
 to ACE 1520 in ratio 1:1

3. Description of achieved results of own researches

3.1. Measuring data

Influence of resin concentration at workability and hardeability of mixtures for various types of opening materials is mentioned at figures 1, 2.

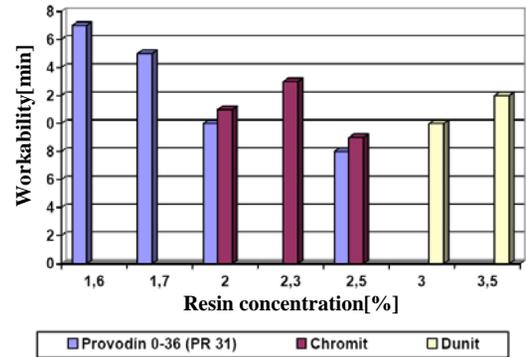


Fig. 1. Influence of resin concentration at workability of mixtures for different types of opening materials

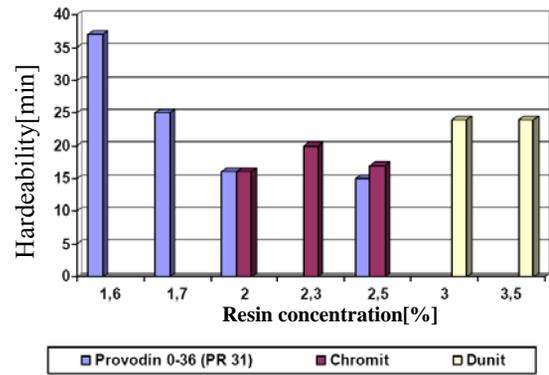


Fig. 2. Influence of resin concentration at hardeability of mixtures for different types of opening materials

On the pictures 3 till 5 are graphic visible measured data of strength weld attributes in dependence ex tempore filling mixture for various resin concentration and by using various forms of opening materials.

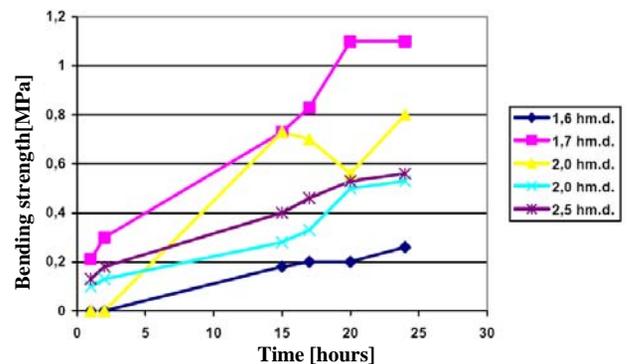


Fig. 3. Dependence of result fortress at curve ex tempore filling mixtures of various resin concentration of opening material Provodín PR 31

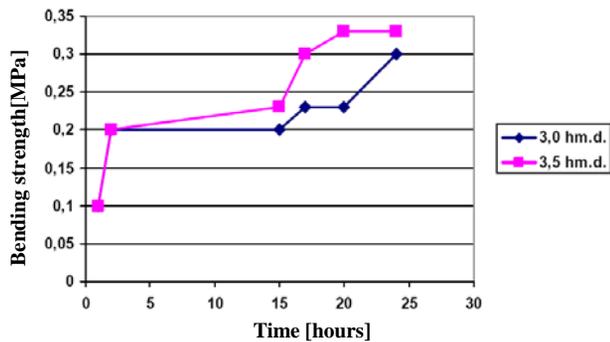


Fig. 4. Dependence of result fortress at curve ex tempore filling mixtures of various resin concentration of opening material Chromit- JAP Trinec

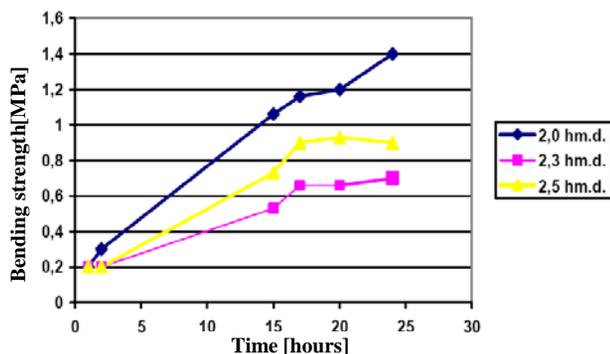


Fig. 5. Dependence of result fortress at curve ex tempore filling mixtures of various resin concentration of opening material Dunit

Test cast is shown at the figure 6. Temperature of casting was 1560 °C, alloy GS 45.3. After the cooling was cast knocked-out from form, whereby it has shown perfect desintergration of mixtures. After the fired inlet system and feeders were cast sanded - blast and after that evaluated. Occurrence cracks decreasing was confirmed.



Fig. 6. Cast „Skrinja“ alloy GS 45.3. gross charge 102 kg

4. Discussion

The Catalyzer 4015 seems to be the best for AlpHaset method. From carried laboratory test results, that for flint opening material Provodin 0 – 36 PR31 it the optimal mixture with content 1,7 weight portion AVENOL resin and 0,34 weight portion catalyzer 4015 at a overall volume resin. Mixture showed the most high fortresses at curve following 24 hours and it had the longest time of degree of workability and hardeability, thereout results that it shall be convenient for use in foundry, for cast stocks till cca 100 kg. Process of dependency of fortresses at curve ex tempore compared with guaranteed values indicated by producers was confirmed. For Chromite opening material is the most optimal an mixture with content 100 weight portion opening material, 2 weight portion resin and 0,4 weight portion catalyzer. Also by the used mixtures was confirmed process of dependency fortresses at curve ex tempore and proved, that chromite opening material for production of cast stock method AlpHaset is able to use. The other way, tests with opening material dunite eliminated its usage for this method. Mixtures with dunit opening material are very fragile and failed parameters required by this method. Is concerns to very fast system of production of forms and cores. By us reached time of workability and hardening confirmed, that optimal mixture could be applied for production of smaller forms eventually cores. For production of bigger pieces is necessary to use AlpHaset method with longer time of workability and hardening, what was proved by semi-operated „Skrinja“, with brutto weight 235 kg. During this semi-operation trial we used 2 types of catalyzators – 4020 and 4015, which were mixed in 1:1 proportion because of time of workability and hardening point of view.

5. Conclusion

Technology AlpHaSet is suitable for production of forms and cores of iron as well as ironless (non- iron) metals. Major attribute of technologies is, that defines thermoplastic property close the medium temperatures before own thermic hardened resin. Thereby expressively compensates expansion of sand, so practically inhibits occurrence effluence and cracks. This fact belongs to major priorities of technology AlpHaset. By using technology there is a two - step hardening. Reaction of own AlpHaset method nets to resin only partially, supplies its sufficient fortress for handling and it makes her thermoplastic in medium temperatures. Heat of cast stock then finishes network and it makes method high dimensions stable and resistant against erosion. This two - step hardening has great benefits for multi heat shirt - sleeved form and cores.

This binder system guarantee excellency surface quality of castings, mainly for steel and modular iron castings, because it does not include neither phosphorus nor sulphur. Also nitrogen absence inhibits creation of pinholes. In the sphere of steel cast stocks AlpHaset technology was established as industry standard in England. There is used to the extent of 90 % in this state. Following these all reasons results that this technology is the most convenient and the most ecological technology for foundry Metalurg Steel s.r.o, Dubnica nad Váhom because of cast stocks ,

made by hand. Obviously have to be quality reclaiming of used opening material. As far as kind of reclaiming, for mixtures, made by Alphaset technology is used thermal and mechanical reclaiming.

References

- [1] R. Brace, W. Stuart, A. Burian, J. Novotný, Výroba forem a jaderdo samotvrdnoucích směsí s pojivovým systémem Alphaset. Slévárenství, 1999.
- [2] J. Fošum, Samotvrdnouce směsi a alkalickými pryskyřicemi a estery. Slévárenství, 1997.