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THE QUALITY OF GI25 OIL PUMP COVER CASTING MADE IN MOLD OF BENTONITE MIXTURE OF ONE FRACTION QUARTZ SAND

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ABSTRACT

In the technology of bentonite mixture mold unexplored fields are the properties of a mixture of a quartz sand fraction 0.106 mm, 0.3 mm and 0.425 mm and the possibility of stacking in horizontal layers in the mold. The investigation is related to the layers of the following combination of sand fractions: 0.3 / 0.106 / 0.425 mm, 0.106 / 0.425 / 0.3 mm and 0.106 / 0.3 / 0.425 mm. Examples of good praxis in castings, smooth surface castings are bound to the use of a model mixture in the front layer casting mold. The results of the research show a high smoothness of the surface of the oil pump cover made in the mold of bentonite mixture from one fraction 0.3 mm of quartz sand.

1. INTRODUCTION

In the castings of the oil pump cover GI25, made in a mold of unique bentonite mixture formed by mixed of the circular mixture and quartz sand additives, surface defects have been observed in the visual inspection: misrun, sand inclusion, slurry inclusion, sintered sand and cold weld. Analysis of the properties of a bentonite mixture with all quartz sand fraction in a unique and circular mixture with and without inacol has expanded the research of a mixture of sand fraction, 0.196 mm, 0.3 mm and 0.425 mm (with and without inacol). The quantity of inacol is determined as the function of the number of grain sand fines. Following the established properties of the mold mixture in the laboratory, the following class of molds are prepared for the oil pump cover casting: unique mixture, a mixture of one sand fraction and horizontal layers of a mixture of a one sand fraction in a mold.

2. EXPERIMENTAL

Experimental studies were conducted through the following phases:

I Quality of GI25 and the bentonite unique mixture in the foundry "Pobjeda" - Turbe.

Preparation of gray cast iron in induction furnace Inductotherm, Turkey, 1.5 t capacity, chemical composition given in Table 1.

Table 1. Chemical composition of Grey iron 25

C	Si	Mn	S	P	Cr	Mo	Ni	Al	Co	Cu	Zn	Pb
3.49	1.94	0.72	0.08	0.04	0.179	0.132	0.048	0.007	0.010	0.203	0.002	0.01

The components of the charge are circular material, steel waste, scrap and hematite iron.

Characteristics unique mixture with a middle size of quartz sand grain 0.2 mm in the foundry are given in Table 2.

Table 2. Properties of bentonite unique mixture in the foundry

Without inacol		With inacol	
Properties	Value	Properties	Value
Compression strengh (kPa)	113.33	Compression strengh (kPa)	121
Shear strengh (kPa)	39.66	Shear strengh (kPa)	48.33
Split strengh (kPa)	30.66	Split strengh (kPa)	36.33
Condensation strengh (N/cm^2)	5.36	Condensation strengh (N/cm^2)	5.93
Shter index (%)	44.72	Shter index (%)	42.84
Permeability	116	Permeability	88

II Testing the properties of a mixture with a single fraction of sand and combinations of horizontal layers of different mixtures of one fraction of sand

The results of the test of the properties of a bentonite mixture of a quartz sand fraction are shown in Table 3; 4 and 5.

Table 3. Properties of bentonite mixture from one fraction sand - 0.435 mm

Without inacol		With inacol	
Properties	Value	Properties	Value
Compression strengh (kPa)	41.6	Compression strengh (kPa)	60
Shear strengh (kPa)	44.3	Shear strengh (kPa)	41.5
Split strengh (kPa)	12.3	Split strengh (kPa)	10
Condensation strengh (N/cm^2)	3.7	Condensation strengh (N/cm^2)	3.6
Shter index (%)	21.77	Shter index (%)	13.04
Permeability	590	Permeability	550

Table 4. Properties of bentonite mixture from one fraction sand – 0.3mm

Without inacol		With inacol	
Properties	Value	Properties	Value
Compression strengh (kPa)	64.3	Compression strengh (kPa)	60
Shear strengh (kPa)	40	Shear strengh (kPa)	57.3
Split strengh (kPa)	10	Split strengh (kPa)	10
Condensation strengh (N/cm^2)	5.36	Condensation strengh (N/cm^2)	5.93
Shter index (%)	44.72	Shter index (%)	13.04
Permeability	440	Permeability	32.84

Table 5. Properties of bentonite mixture from one fraction sand – 0.106 mm

Without inacol		With inacol	
Properties	Value	Properties	Value
Compression strengh (kPa)	41.6	Compression strengh (kPa)	77.6
Shear strengh (kPa)	53	Shear strengh (kPa)	40
Split strengh (kPa)	12	Split strengh (kPa)	13
Condensation strengh (N/cm^2)	2.8	Condensation strengh (N/cm^2)	2.96
Shater index (%)	55.93	Shater index (%)	45.4
Permeability	119.3	Permeability	68.6

Testing the properties of samples with horizontal layers mixture of one sand fraction is given in the Tables: 6, 7 and 8.

Table 6. Samples with horizontal layers of one sand fraction, combination: 0.3 / 0.106 / 0.425 mm

Without inacol		With inacol	
Properties	Value	Properties	Value
Compression strengh (kPa)	40.25	Compression strengh (kPa)	42.6
Shear strengh (kPa)	17	Shear strengh (kPa)	16
Splits strengh (kPa)	18.3	Split strengh (kPa)	15
Condensation strengh (N/cm^2)	3.1	Condensation strengh (N/cm^2)	5.3
Shater index (%)	64.31	Shater index (%)	54.2
Permeability	190.3	Permeability	132.3

Table 7. Samples with hrizontal layers of one sand fraction, combination: 0.106 / 0.425 / 0.3 mm

Without inacol		With inacol	
Properties	Value	Properties	Value
Compression strengh (kPa)	32	Compression strengh (kPa)	37.6
Shear strengh (kPa)	17	Shear strengh (kPa)	12
Split strengh (kPa)	13.3	Split strengh (kPa)	14
Condensation strengh (N/cm^2)	3.46	Condensation strengh (N/cm^2)	4.3
Shater index (%)	57.8	Shater index (%)	45.8
Permeability	199.6	Permeability	172.6

Table 8. Samples with hrizontal layers of one sand fraction, combination:0.106 / 0.3 / 0.425 mm

Without inacol		With inacol	
Properties	Value	Properties	Value
Compression strengh (kPa)	38.3	Compression strengh (kPa)	41.6
Shear strengh (kPa)	17.3	Shear strengh (kPa)	18.3
Split strengh (kPa)	15.6	Split strengh (kPa)	15.6
Condensation strengh (N/cm^2)	3.1	Condensation strengh (N/cm^2)	4.4
Shater index (%)	56.6	Shtaer index (%)	44.9
Permeability	131.6	Permeability	127.3

III Analysis of castings deffects

In the "Pobjeda" foundry d.o.o. - Turbe, with the visual inspection of the oil pump cover castings, the following defects were found: misrun (8%), sand inclusion (80%), slag inclusion (7%), sintering sand (2%) and cold weld (3%).

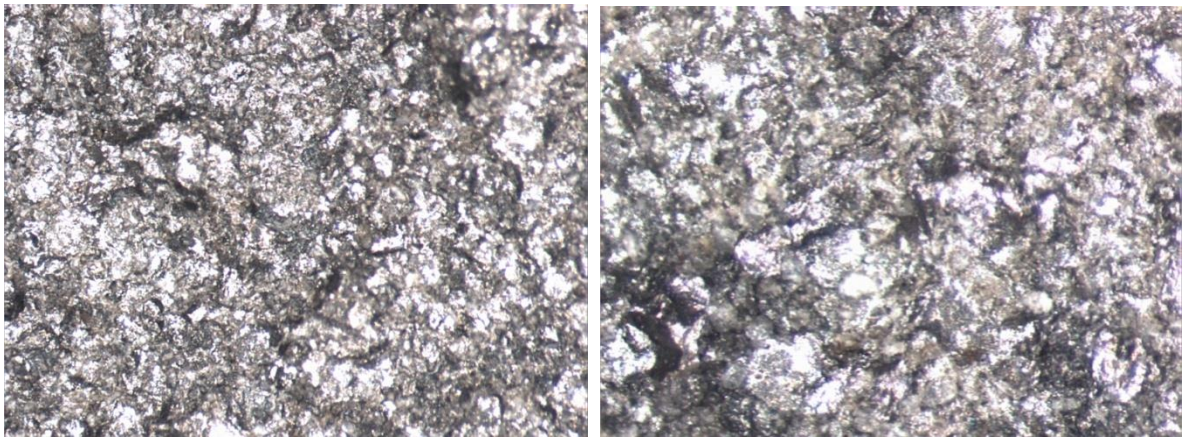
Casting of oil pumpe cover are shown on Figures 1 - 6. Figures 5 and 6 are made by optical microscope.

Figure 1. Sand fraction 0.3 mm with inacol

Figure 2. Sand fraction 0.425 mm with inacol

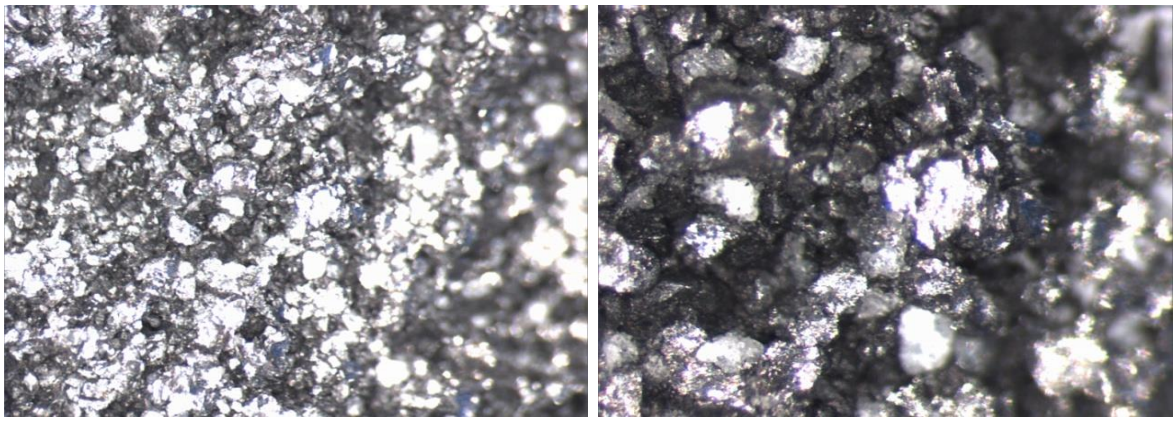
Figure 3. Sand fraction 0.3 mm without inacol

Figure 4. Sand fraction 0.105 mm without inacol



a) b)

Figure 5. Surface of casting, sand fraction 0.105 mm with inacol: a) 25x and b) 60x



a) b)

Figure 6. Surface of casting, sand fraction 0.3 mm with inacol: a) 25x and b) 60x

In the case of three different sand fractions in a mold mixture with inacol, the surface of the casting at least roughly shows the fraction 0.105 mm, Figure 5. The free surface without a sand inclusion, shows the fraction 0.3 mm with the addition of inacol, Figure 1 and Figure 6. The mat print of surface oil pumpe cover casting is the case of sand fraction 0.425 mm in mold mixture, Figure 2. Evidence of defects in castings made in a bentonite mixture mold without the addition of inacol, sintered sand covers the casting surface in cases shown in Figures 3 and 4, and due to high reflection the optical microscope did not give a clear picture or a glossy print.

3. DISCUSSION

- The analysis of copression strength, shear strength, condensing strength and split strength of different granulometric sand compositions show that the compression strength and the condensation strength increase with the addition of inacol, whereas the shear strength and the

split strengh decrease with the addition of the inacol. The Shater index and the permeability drop with the addition of inacol.

- The compressive strength of the bentonite mixture of sand fraction 0.3 mm is maximum, the highest values of the Shater index shows a mixture of sand fraction 0.106 mm and the maximum permeability of a mixture of sand fraction 0.425 mm.

- The mold/ sample formed by horizontal layers of bentonite mixtures of three different quartz sand fraction shows the highest strength values and Shatter index for the conbination: 0.3 / 0.106 / 0.425 mm sand fractions, while the highest permeability of combination:0.106 / 0.425 / 0.3 mm sand fractions.

- Visually inspecting the surface of the oil pump cover, GI25, has the highest quality poured into a mold mixture of sand fraction 0.3 mm inacol. There are obvious defects in the cover surface made in a mold without inacol. In cases of three different fractions with inacol, the surface with the least roughness shows the fraction 0.105 mm.

4. CONCLUSION

From the exploration of the properties of the bentonite mixture of quartz sand and one sand fraction, molds are made as a combination of horizontal layers of different mixtures of various quartz sand fractional in the production of the SL25 oil pump cover. The following conclusions can be drawn:

- A sand fraction 0.3 mm erosion resistant mold matches the best surface of the SL25 oil pump cover.

-The combination of horizontal layers of bentonite mixture of a one fraction of sand is 0.3 / 0.106 / 0.425 mm, without mold erosion

The concept of exploring bentonite mixture of a quartz sand fraction opens new techniques of mold making in layers to achieve dominant properties such as Shater indexe or permeability that are not typical of a unique mixture. The results of these researches provide a new impetus to question the quartz sand and bentonite bonding mechanism.

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