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ARCHIVES of FOUNDRY ENGINEERING

VERSITA

DOI: 10.2478/v10266-012-0028-7

ISSN (2299-2944)
Volume 12
Issue 2/2012

Published quarterly as the organ of the Foundry Commission of the Polish Academy of Sciences

15 – 18

The Estimation of Quality Refining Slag for the Brass Gas-Slag Refining

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Received 18-05-2012; accepted in revised form 31-05-2012

Abstract

This article contains information concerning of the analysis the possibility of defining refinery qualities of the slag based thermophysical and thermodynamical data. The paper presents a model of slag refining processes and a method of determining the reduction capability of slag solutions. Slag was analysed with the use of the DTA methods for the brass melting conductions. The study of computer program including the satisfactory number of data there are used in to the design a modern device rotating head used for gas-slag refining. It was achieved that the refining gas and fluxes were distributed ever by the rotating head. High effectiveness of the gas-slag refining processes was proved for the brass.

Keywords: Brass, Gas Refining, Slags, DTA, Computer Program, Optimisation

1. Introduction

Slag extraction is commonly used in the casting processes of melting copper alloys. An alternative for the method is gas-slag refining in where the concentration of impurities extracted by the slag is obtained. Most of the experiments have shown that in this way is possible to achieve optimum economic and technological results [1-4].

This article contains information concerning of the analysis the possibility of defining refinery qualities of the slag based of the thermo-physical and thermodynamical data [5-7]. The issues presented deals not only with refining copper and melting stages, but also of the idea building an optimization program. In its assumption the program is supposed to check and search specific data very quickly on the particular types of slag. There are possible and purposeful the construction optimization program engaging all of the physics chemical influence the slag in processes of melting metals alloys. The proposed results, ranges of areas on graphs of phase equilibria's, demonstrative on the optimum values, will be verified in laboratory conditions and industrial.

The initiation the new data the gathered base will be built in system of open base enabling In the presented work it has been decided to show the results of laboratory and industrial investigations of the CuZn39Pb2 alloys.

2. The description of the laboratory and working computer programme

The laboratory stand is showing at the picture 1. The alloy marked as MO59 was melted in an induction's crucible furnace with the capacity 10 kg, then casted in metal moulds.

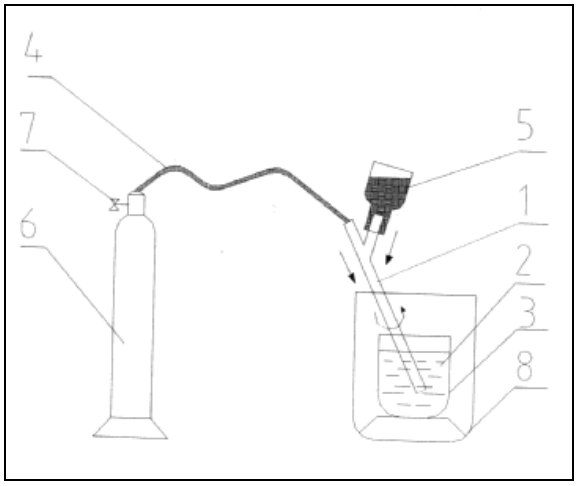


Fig. 1. The scheme of testing installation, where: 1- metal lance, 2- liquid metal, 3- melting pot, 4- rubber line, 5- slag container, 6- cylinder with argon, 7- stopcock, 8- furnace

Worked out SlagProp program [8] need finishing up yet. Necessary DTA is introduction of peck of data and their verification method. The database, in system SQL, it will be accessible in aim fuel make-ups by different users. It was it been possible was already now however to move following:

- there are possible and purposeful the construction optimization program engaging all of the physics chemical influence the slag in processes of melting metals alloys,
- the proposed results, ranges of areas on graphs of phase equilibria's, demonstrative on the optimum values, will be verified in laboratory conditions and industrial,
- the initiation of the new data the gathered base will be built in system of open base enabling.

User has the possibility of filtration of database physics chemical also, thanks what it gets information about occurrence in arrangement of areas fulfilling passed by him criterions. After he recess kind it writes down he the limits the value of definite proprieties. The sent suitable form thereon becomes the basis from data to database. After correct realization question user gets in tabular figure information about possible occurrence about set proprieties areas. The result of question was it been possible additionally to broaden about information about remaining proprieties physic-chemical. Besides, in aim the image of location about set properties the area on graph Gibbs (Fig. 2), the special navigator was created. After recess area and his click, displayed arrangement 3 becomes user - phase from noted on him at present under examination area. The principle of filtration of database was introduced physics chemical (Figure 3). It the pattern of conduct in the work was presented the permissive on calculation for arrangement of oxides Al_2O_3-SiO_2-CaO- B_2O_3 optimal co-ordinates areas in reference to conditions of fusion silicon bronzes. Moved analysis was provided to carry to traditionally appointive in metallurgy of data in basing about measurements of stickiness and melting-point. It was showed on the Figure 4 and they allow on the determining range favorable compositions - appointed with letters polygons.

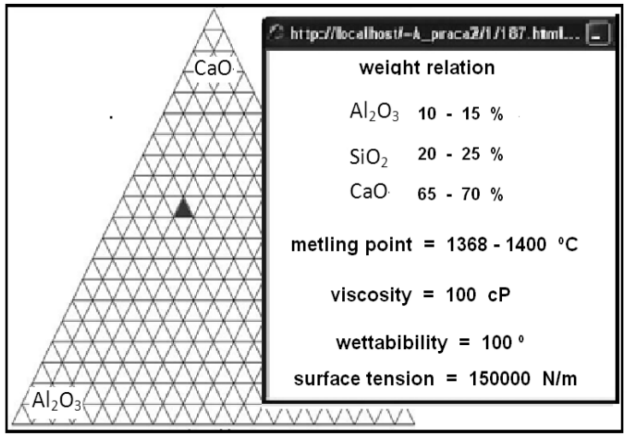
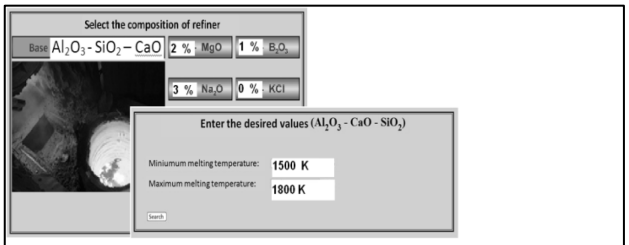


Fig. 2. Principle of procurance of information the regard of indicated area: user clique opens on passed area, then mouse representative window his propriety physics chemical



Minimal temparature K	Maximal temperature K	Minimal value Al_2O_3 %	Maximal value Al_2O_3 %	Minimal value CaO %	Maxima value CaO %	Minimal value SiO_2 %	Maximal value SiO_2 %	Surface tension limits N/m
1500	1700	0	5	20	25	70	75	305
1500	1700	15	20	0	5	65	80	390
1500	1549	20	25	45	50	25	30	305
1500	1596	25	30	40	45	25	30	304
1500	1596	25	30	5	10	65	70	100
1500	1700	25	30	5	10	65	70	184
1530	1680	20	25	10	15	60	65	

Fig. 3. Presentation of results of filtration of database the regard the limits the value the chosen proprieties the physic-chemical

Optimization with proposed program shown on appointed with triangle area. However the investigation DTA, from utilization the method of differentiation of thermal effects and mass, shown on appointed with wheel area.

In virtue of the previous investigations the reducing slag (S1) selected one based on the oxides (Tab. 1) with additions 40% CaC_2 and 20% Al as activators was used.

Table 1.
The slag compositions

	Al_2O_3 %	$Na_2B_4O_7$ %	SiO_2 %	NaCl %	NaF %	$AlCl_3$ %	EW* kJ/mol
S1	40	30	10	10	10	----	-45
S2	-----	40	----	40	----	20	-80

*reaction arrangement – EW [9]

3. The manufacturing technology

The coating is of high – active slag (S1 – Tab. 1.) activated with 40% compound carbides (mixtures CaC_2 and Al_4C_3 as 8:1). The reducers of this kind not only make it possible to keep a constant deficit of impurities in the slag layer but also let carbon and metals actives factors in the melting atmosphere. Thus as result, reducing conditions of melting are obtained which allows to avoiding negative oxygen and hydrogen interaction. In the course of melt a chemical constitution of the alloy with glow LECO GDS 750 is corrected.

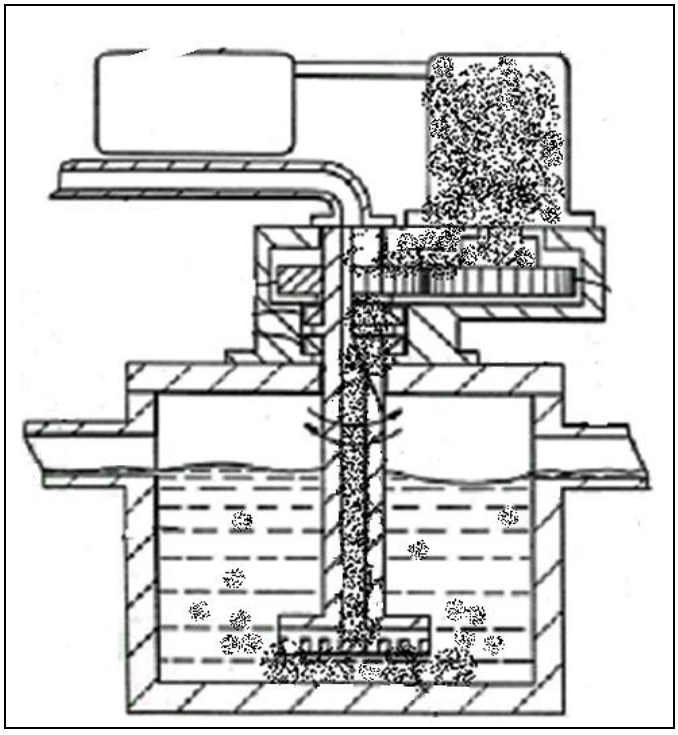


Fig. 4. The scheme of ECOLASER installation.

Before spilling the metal prepared in this way is refining during 5 minutes with gas-argon and fluxes (S2 – Tab. 1) there are distributed every by the rotation head – ECOLASER (Fig. 4)

Table 2.
Results of the chemical and mechanical analysis

	R_m [MPa]	A5 [%]	**P_o [%]	O_2 wt[%]	P wt[%]
S1 +CaC_2 and Al_4C_3 *+ Ar	392	15,5	1,7	0,0057	0,031
S2 + CaC2 and Al4C3 * + Ar	400	16,2	1,4	0,0030	0,0028

*40% compound carbides to the slag (mixtures CaC_2 and Al_4C_3 as 8:1), ** porosity

The Table 2 presents the results of chemical analysis and mechanical properties before and after gas-fluxes refining. Pictures 5 shows the microstructure with has been obtained. Later there are the another slag (according Tab. 1) with argon in to the melting brass introduced.

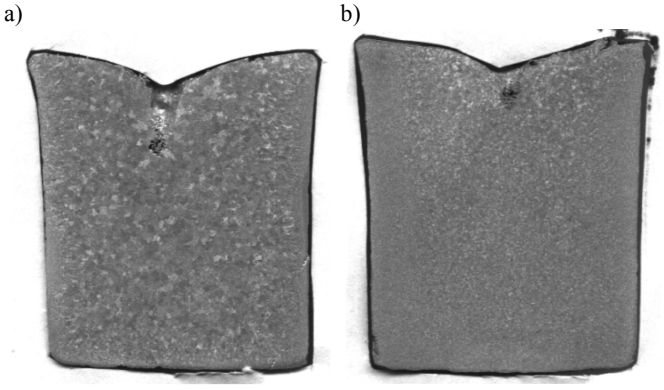


Fig. 5. Macrostructure of the: a) brass after refining with the S1, b) after refining with the S2

4. Conclusions

It was it been possible was already now however to move following there are possible and purposeful the construction optimization program engaging all of the physics chemical influence the slag for the CuZn39Pb2 in processes of melting and refining process. Database analysis showed, that the most profitable effects of the refining from among analysed slag to this alloys should oneself to expect after combination of mixtures S1.

The alloys in accordance with the presented technology have very good properties, flowing power and degree of fineness structure homogeneity and little loss in remelting. The high technical – economic indexes characteristic of the technology for the manufacturing of brass have been obtained through the application active slag and helping process through the refining of another slag introduced with argon into the melting alloy.

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