The property estimation of copper alloys refining slag with the stimulators addition use the database

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Abstract

The paper presents the analysis and investigation of the state of art in the field of metallurgy copper alloy in the reduction conduction. This article contains information concerning the analysis of the possibility of defining refinery qualities of slag based of the thermophysical and thermodynamical data. The isues presented deals not only with refining copper and melting stages, but also the idea of 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. In the presented work it has been decided to show the results of the industrial investigations obtained with reference to copper alloys in the reduced melting conduction.

Keyword: slags, computer program, copper alloys.

1. Introduction

The effectiveness of diffusive influences depends from physics chemical propriety, they change in route of next phase of melting. The phase of melting were allowed to divide on two stages. In the first stage comes to gradual heating charge of the metal which accompany reactions from external atmosphere. In second stage, wheres metal is able already liquid, comes to influence of factors of atmosphere with the slag surface and metal. It during this phase comes to many complicated relationships and reaction among participating in process of refinement components. The of setting reactions dependent intensity from construction of the stoves and other features of individual foundries also. The influence of the atmosphere on slags refinement brings continuous disturbing of thermodynamical equilibrium among slag and metal. In the slag influences considerable part it was been possible to attribute superficial phenomena, in this surface tension. During refinement comes however to many chemical reaction in the chapter of phase among atmosphere, the slag and metal. It causes then the changeability of conditions in the time, impossible to regard. Besides , slag it are not dispersoids, and superficial analyses' are fully well-founded only then. During investigation of remembered angles it was used solid phase and liquid. However in the refining processes comes to influences of two liquid phase. Influences arrangement were tried also to describe as series arriving chemical reaction among reacting substances in slag, non – metallic, as well as atmosphere interfering. However these reactions overlook in turn the part of superficial phenomen. The simultaneous carrying out of investigations over stickiness, conductivity, kinetics of exchange of masses turned out little reliable also.

2. The analysis of the slag estimation

2.1. Conception of building of the programme

The study of computer programme including the satisfactory number of data, both thermodynamical how and experimental - gathered with literature and own investiganion, the simpler qualification of optimum proprieties of slag would make possible. Settled by programme of areas the verification it is possible to the end to conduct in the support about proposed by A. W. Bydałka [1] the method of the modelling processes of refinement from it utilization the derivatograph or directly in conditions industrial. User starting program [2] should have the possibility of choice kind of the information, he would like to get which. Should to have the possibility of indication interesting him composition and displaying on his subject all accessible information. He from second side should have the possibility of introduction border data the arrangement also, which would like to receive. The principle of working of programme was introduced on drawing 1.
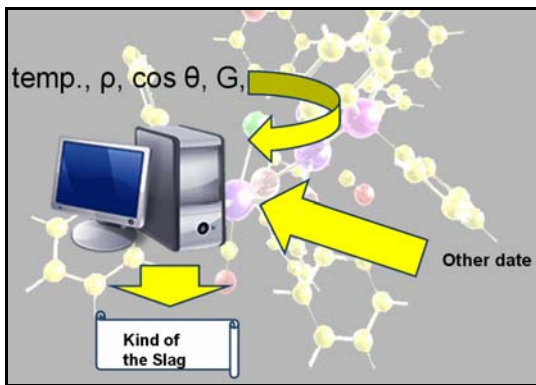

Fig. 1. Ideological scheme kelter of the programme

Accepting the jump near division of system what 5%, for simple system Gibbsa it gets oneself 400 different areas. Areas these were one should describe in support about data with literature and experiences. In proposed programme will be possible introduction to basic arrangement fourth component, for example the admixture or stimulus of reaction. In this way programme will make possible the individual modifications of composition. Near remembered frequency of sampling arrangement the quantity of information will grow up to 1600 elements then and gives the spatial figure. So the peck of information and necessity of management the datum feature, the SQL shows on choice of language. The language SQL is the structural language the servants to building, creating, of modifying and the management the database. Every gathered during literature analyses' and investigations information in basis this will be kept. Constructing it it is possible suitable questions from database to get different information, which can be sorted, grouped and filtered in any prepare. At random chosen compositions will become verified in real conditions obviously. The investigations were planned for processes the refining the copper chosen alloy. Gathered data could also find for different alloys use. The interface of programme be becomes leaning on fenestrate graphic coat, not only with aesthetical visual

regards, but also the simplicity of service of programme. The utilization in this aim will become the HTML as well as language PHP enabling the implementation of query structural language language. The database will be open and will make possible initiation own data got with or observation industrial investigations. It was it been possible was already now however to move following:

- there are possible and purposeful the construction optimization programme 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.

2.2. Investigation

After actuation programme and introduced three-phase user Gibbs arrangement becomes the recess the suitable kind of the slag material, for example oxides diagrams. It is then equilateral triangle which tops answer the concrete entering in composition of studied material substance. Every point in arrangement answers the not only different quantitative composition of substance, but it be characterizes different proprieties physics chemical also.

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.

Arrangement was partite on 400 areas, which answers changes composition of material, what 5 % on every component. Restricting area and division him what 5 % makes possible the comparatively precise qualification of propriety studied material regard of his molar composition. User it after recess any area, clicking on him, gets information about the most important proprieties him characterizing. Additionally following drawing represents the principle of procurance of information the regard of passed area and kind of the alloys (Fig. 2).
After correct realization [7] question user gets in tabular figure information about possible occurrence about set proprieties areas. The results of question was it been possible additionally to broaden about information about remaining proprieties physic-chemical of the slags – in this work for CuSn5Zn5Pb5 and CuSn10P alloys. It the kind of the database was presented the permissive on calculation for arrangement of oxides Al_2O_3-SiO_2-

CaO with the B_2O_3 , Na_2O and MgO (Table 2) optimal co-ordinates areas in reference to conditions of this alloys.
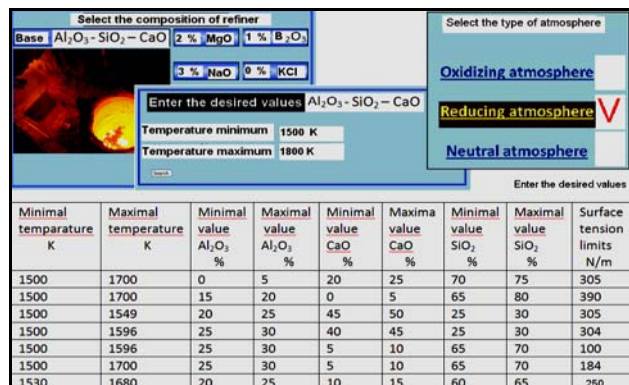

Fig. 3. Presentation the programmscreen and the results of filtration the database the regard limits of the value chosen physic-chemical proprieties

Finally in result of currently conducted research and analysis it has been established that complex influences in referenced reaction arrangement $Q_1 – Q_2$ can be shown by an energetic reaction energi - EW and mass - r indicator, which value are a result of comparing reaction heat of properly selected mixtures (Tab. 1).

The recently elaborated method of observing effects of co-reaction between slag and oxide inclusions made possible to estimate the reduction capacity of the slag composition (Table 2), with addition reagent as another metal, carbon and carbide and reactions slag stimulators (Table 1), in comparison to the CuSn10P and CuSn5Zn5Pb5 alloys melting conditions. Carbon, carbide (CaC_2 or Al_4C_3) and metal, as carbide-originating elements (in this work Al), are used to created condition lake as reducing [1, 8], in real melting conduction the CuSn10P or CuSn5Zn5Pb alloys.

In the experiments the refined alloys are replaced, according with the described methods with follow oxides:
- CuSn10P alloy with $Cu_2O(60\%)$, SnO(20%), $P_2O_5(20\%)$ – compounds 1.1-1.4,
- CuSn5Zn5Pb5 alloy with $Cu_2O(5\%)$, SnO(15%), ZnO(50%), PbO(30%) – compounds 2.1-2.4,
which oxides respond with the melting losses of its alloys in the real metallurgical condition.

3. Conclusions

It was it been possible was already now however to move following there are possible and purposeful the construction optimization programme engaging all of the physics chemical influence the slag for the CuSn5Zn5Pb5 and CuSn10P in processes of melting and refining process. Database analysis showed, that the most profitable effects of the refining from among analysed slag to the CuSn10P alloys should oneself to expect after combination

Table 1
Schema of the investigation – kind of the used stimulators and DTA results

1	4	5
No	Stimulators [wt. %] *	Indicators EW – kJ/mol WN r - % mas
1.1	-----------------------	EW = 0,0 kJ/mol r = -2,5%
1.2	5 - Na_2CO_3 + NaCl (2:1)	EW = -24,0 kJ/mol r = -8,0%
1.3	5 - NaCl + NaF + CaF_2 (1:1:1),	EW = -70,0 kJ/mol r = -12,0%
1.4	5 - $Na_2B_4O_7$ + NaF (3:1).	EW = -168,0 kJ/mol r = -19,0%
2.1	-----------------------	EW = 0,0 kJ/mol r = -3,0%
2.2	5 - Na_2CO_3 + NaCl (2:1),	EW = -40,5 kJ/mol r = -17,0%
2.3	5 - NaCl + NaF_2 (1:1)	EW = -18,0 kJ/mol r = -42,0%
2.4	5 - $Na_2B_4O_7$ + NaF (3:1).	EW = -19,0 kJ/mol r = -31,0%

Table 2
The content (wt. %) of basis slag compositions after analysis with the database

Al_2O_3	B_2O_3	CaO	Na_2O	SiO_2	MgO
9	1	22	8	56	4

of mixtures stimulating No 1.4. For this composition are EW marked on –168kJ/mol and r on –19,0% and this investigation result point at $Na_2B_4O_7$ + NaF (3:1) as the best stimulator for analysed slag. From other DTA analysis can be say that best should be the slag 2.2. However it is now from labour and industrial investigation that Na_2CO_3 after dissociation can give substance about oxidising characteristics. The stimulator composition 2.3 contain only fluoride and chloride there are not indifferent for health the worker at the furnace.

This assented as a confirmation of the following foundations that reduction conditions should be chosen on copper alloys deliberately. But the essential emphasis should be put on properly elaborated factors of multistage reaction with essential usage of suitable stimulators, a specialy ekological as where possible. The paper presents the analysis and investigation of the state of art in the field of metallurgy copper alloy in the reduction conduction wit use the database. In the presented work it has been decided to show the results of the laboratory investigations obtained with reference to Cu-Sn and Cu-Zn alloys in the reduced melting conduction. The slag constitution with the carbon carbide and carbon, as e complex reagents, has been applied in metallurgical and foundry conduction. This assented as a confirmation of the following foundations with reduction conditions should be chosen on copper alloys deliberately but the essential emphasis should be put on properly elaborated factors of multistage reaction with essential usage of suitable stimulators.

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