Analysis of the possibility of estimation slags propriety with use the database

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Abstract

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.

Key words: slags, computer programme, optymalisation

1. Introduction

During melting slag refining moves diffusively extracting on the dirts dissolved in melted alloy. The insulation from atmosphere the liquid metal is their exercise also. Therefore also in analysis of the problem all influences, as well as in built programme of optimization, be considered become possibly. Especially the perturbative these main task slag. The building conception of the optimization programme in this aim be becomes introduced.

1.1. Refinement of alloys of metals and phaze of melting

Slag extraction is universally well-known method. Basis phisics chemical describes Nernst principle (1) :

$$L(N) = A1(N)/A2(N) \qquad (1)$$

The effectiveness of diffusive influences depends from phisics chemical propriety, they change in route of next phaze of melting. The phaze 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, whenas metal is able already liquid, comes to influence of factors of atmosphere with the slag surface and metal. It during this phaze 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.

1.2. Influence of the slag

Influence of the it was been possible to consider in plane his reaction from atmosphere and melted metal. 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 phaze among atmosphere, the slag and metal. It causes then the changeability of conditions in the time, impossible to regard. Besides, slags it are not dispersoids, and superficial analyses' are fully well-founded only then. Table 1 shows on the different measuring conditions, making difficult comparing the results of investigations the superficial proprieties,.

Only the description angles of humectation places the considerable challenges. During investigation of remembered angles it was used solid phaze and liquid. However in the refining processes comes to influences of two liquid phaze. 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.

Influence between metal and slag was been possible to describe with the help theory of the double electric layer. This conception makes possible the explanation for example the mechanism of deoxidation. Function Lippman'a (2) it permits to consider as well as phenomenon superficial setting reactions. It sets aside however time.

$$P_p = \varepsilon \cdot d\sigma_m + \Sigma\mu_0 + da_d \qquad (2)$$

The simultaneous carrying out of investigations over stickiness, conductivity, kinetics of exchange of masses turned out little reliable also. They shew as on large changeability of whole arrangement in time.

2. The analysis of the slags estimation

How it already earlier remembered was, it was many enabling methods be well-known the delimitation of select proprieties of the slags. Stickiness most often was marked using the method of falling ball (Stoks method). They be well-known on Hoppler's viscometers. To mark mighty stickiness using with the method of concentric cylinders also, flow through tube, vibratory method or rotameter. Methods these set aside however nor the time nor products of reaction.

Wettability to mark with the help of mighty method lying drop, plate sloping or Wilhelmy method. The methods of lying drop it been possible also to mark surface tension. The surface tension was it been possible also to measure with the help of the drop pendant method, the capillary eminence, weighing of drop, severance, or else the immersion method. However in case of high-temperature measurements methods these lose their usefulness. It was encountered on connected with selection suitable materials to carrying out such investigations. It is also hard to eliminate chemical reactions, which lead to considerable mistakes.

Table 1.
Demonstrative on variety of laboratory conditions near determination the propriety of superficial slags composition.

	Propriety			Measuring conditions				
Literature	Stickiness	Wettability	Melting-point	Atmosphere			Regard time	
	R*	MA*	LK*		Air	N$_2$	Ar/He	yes	no
14				X	X				X
15	X						X	X	
16			X				X	X	
17				X		X			X
18		X					X		X
19		X					X	X	
20				X	X				X

Explanation: The R * - the measurements of stickiness by the rotameter, it HAS * - the settlement the stickiness from utilization the right Archimedesa, the LK - the method of lying drop

All methods have their positive and downside. Table 2 represents the border angle of humectation in dependence from conditions of fusion. It was it been possible to notice that the angle of humectation alters in dependence his values from experimental conditions considerably. In temperature 1173^{0}C, at free access of air the wettability of copper rest of the slag carries out about 100^0. However it in graphite muffle did not it come to her fusion even. She in temperature 1373^{0}C, near free access of air carries out about 150^0, in ceramic muffle 140^0, and in graphite muffle only 90^0. Among measurements steps out 60% difference in results.

How to be visible results conducted experiences, they differ inter, se making impossible comparing. This concerns also the thermodynamical collected in systems of phase equilibria's data. It it for example was it been possible was to analyse on the ground results investigations Rankin and Wright as well as investigations MBH Dusseldorf and results on the ground investigations of Muran and Osborn relating arrangement Al$_2$0$_3$- SiO$_2$-CaO. Taking for example composition żużla: 90% Al$_2$O$_3$ as well as 10% SiO$_2$, first investigations show that his temperature of fusion sets up really after crossing 2000^{0}C, however second investigations show that it carries out below 1900^{0}C considerably.

Table 2
The wettability of copper and slag (Al2O3-SiO2-CaO) with the mixture the oxides the brass [13]

Temperature K	Border angle of humectation in dependence from conditions of fusion		
	Near free access of air	In ceramic muffle	In graphite muffle
900	100 ± 5^0	100 ± 5^0	They were melted
1000	140 ± 5^0	120 ± 5^0	80 ± 5^0
1100	150 ± 10^0	140 ± 10^0	90 ± 5^0

3.Conception of building of 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 slags 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. Bydałek [2] method of the modelling processes of refinement from it utilization the derivatograph or directly in conditions industrial.
User starting programme 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 drawings 1 and 2.
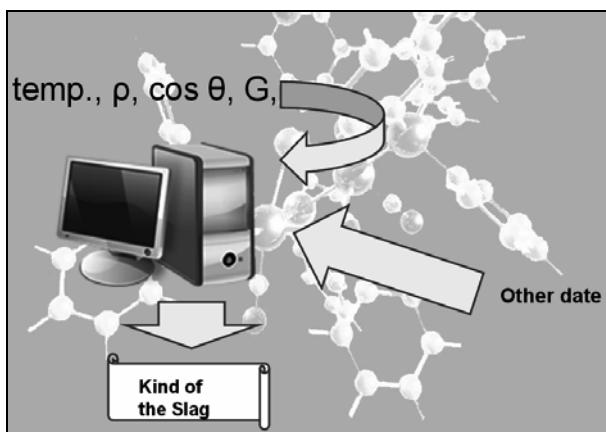

Fig. 1. Ideological scheme kelter of the programme

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.
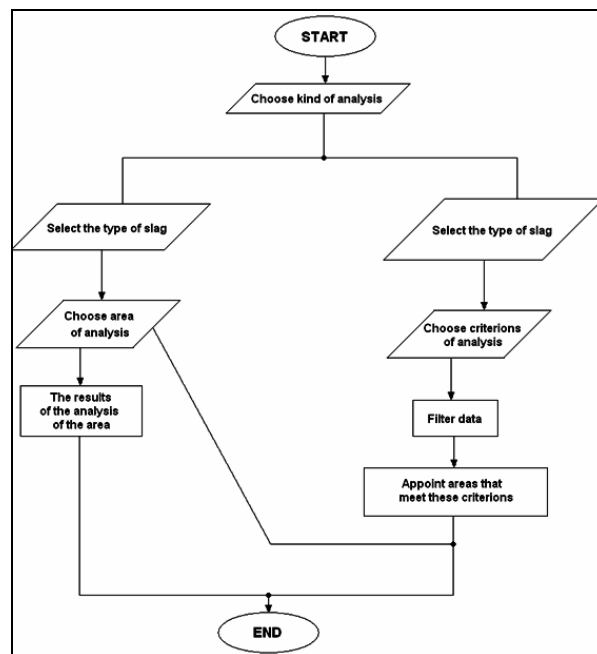

Fig. 2. Algorytm of the proposed optimization programme

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 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.

4. Summary

There are possible and purposeful the construction optimization programme engaging all of the phisics chemical influence the slags 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.

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