TECHNOLOGIES FOR PROCESSING OF METALLURGICAL SLAGS

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Iron metallurgy produces huge quantities of various types of slags containing substantial proportions of metal elements that could find re-utilization in the metal working industry. This contribution deals with the problem focused on extracting of metal parts from slags by the means of re-melting. Selection of suitable technology could result in possibility of re-utilization of such commodities.

I. Introduction

In the industrial branch of iron metallurgy various types of accompanying slags origin during the processes of melting metal out and consequent heat treatment. These slags have varied chemical composition. This is dependant on the initial composition of ores and concentrates treated as well as on added additives during the heat processes. At present majority of slags produced have their use in industry of building materials production, in ceramics, and further in transport infrastructure, construction works connected with the problem of reducing the load on the environment.

Numerous slags in particular steel, foundry slags and slags from production of non-ferrous metals contain compounds of metals that can be recycled in the metallurgic process. The said recycling has been at present limited only to the processes connected with mechanical treatment and afterwards by the means of magnetic separation they are returned back to the technological process. That is why additional methods of treatment are searched which might supplement the existing processes and thus enhance gaining efficiency of the desired metals.

II. Practical Part

II.1 Sampling

For purposes of experimental monitoring such slags (Table no.1) have been selected, that originate in processes of steel production by various technological procedures. Composition of individual types of slags is mentioned in the Table no. 2. As the receiving measurement shows the said slags contain a high portion of metal and thus important changes can be anticipated during further high-temperature processes.

Table 1 - Analyzed samples of slags

Sample marking	Sample specification
Sample no. 1	Steelworks cast slag
Sample no. 2	Steelworks slag rapidly cooled down
Sample no. 3	Steelworks slag from electrical furnaces

Table no. 2 - Receiving composition of listed samples of slags

Sample no.		1	2	3
MEASURED RESULTS %	Fe_{kov}	-	0,60	0,60
	FeO	29,75	23,80	10,75
	Fe_2O_3	1,31	8,17	3,91
	MnO	3,86	3,56	4,54
	Cr_2O_3	0,61	0,57	0,82
	V_2O_5	0,13	0,11	0,16
	TiO_2	0,23	0,22	0,07
	CaO	36,30	38,03	23,48
	K_2O	0,31	0,30	0,32
	SiO_2	11,35	10,91	8,96
	Al_2O_3	1,57	1,70	1,73
	P_2O_5	1,11	1,03	0,34
	MgO	10,66	8,29	33,09
	Na_2O	0,19	0,21	0,23
	BaO	< 0,01	< 0,01	< 0,01
	F^-	0,26	0,83*	9,83*
	Cl^-	0,63	0,73	0,48
	C	0,04	0,04	0,04
	S	0,09	0,04	0,04
	Zn	< 0,01	< 0,01	< 0,01
	Pb	< 0,01	< 0,01	< 0,01
	Cu	< 0,01	0,01	< 0,01
	Cd	< 0,01	< 0,01	< 0,01
	Ni	< 0,01	< 0,01	0,01
	Sr	< 0,01	< 0,01	< 0,01

II.2 Preparation and Performance of Experiments

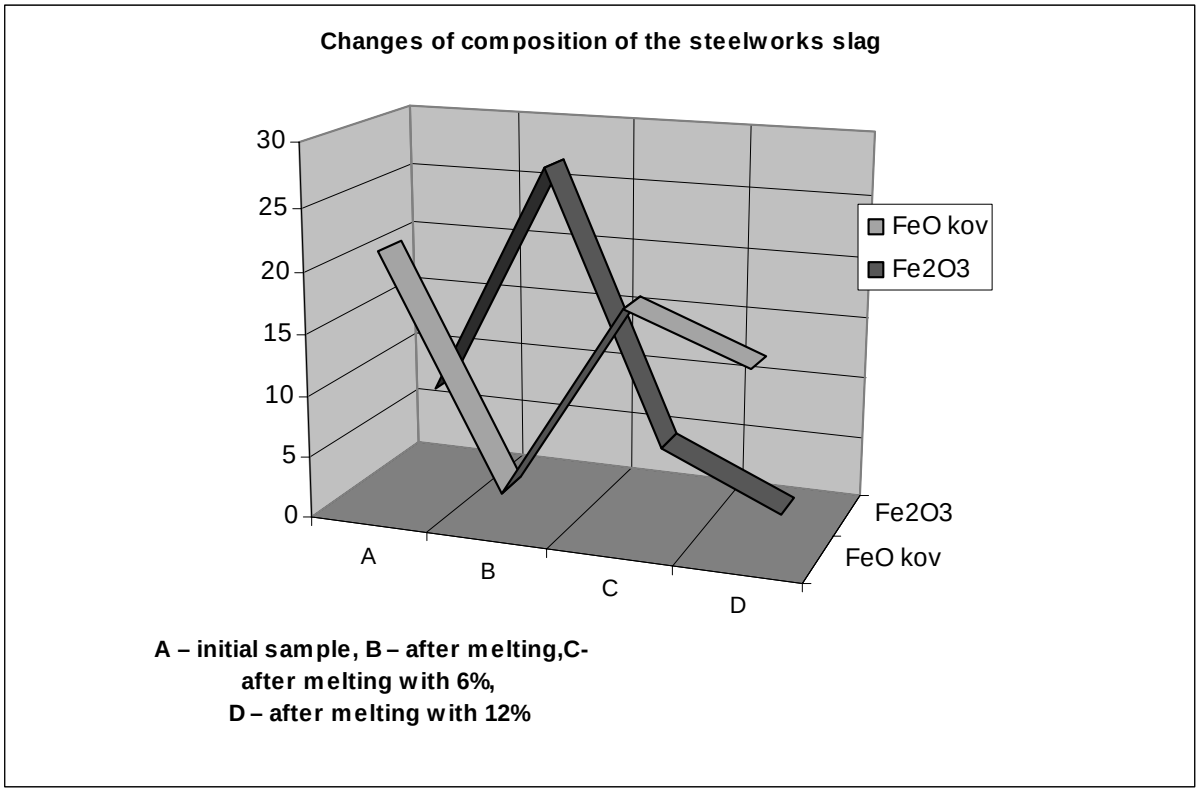
Based on preliminary experiments which were carried out with the help of the method called pattern analysis, the conditions for laboratory melting tests of individual slags have been determined. With regards to chemical composition and the course of melting tests the experimental works were extended by processes of re-melting of slags with addition of carbon as a reducing agent. (addition 6% and 12%).

Final temperature of melting was specified to 1 490 ºC with thermal buildup of 10 ºC/min in the laboratory high-temperature furnace with program increase of temperature. After achieving the specified temperature and the period of holding of 30 minutes the samples were slowly cooled down to the room temperature. Result-

ing values of the material process of melting in relation to the main commodity monitored, i.e. content of Fe is shown in the following Table no. 3.

Table 3 - Material balance of melting process

Sample no.		Sample (original) (%)	Sample (after melting) (%)	Change (%)
MEASURED RESULTS, %	1	100	100,62	+ 0,62
	2	100	100,69	+ 0,69
	3	100	100,42	+ 0,42
	4 (6% C)	100	98,26	- 1,74
	5 (6% C)	100	97,26	- 2,74
	6 (6% C)	100	96,71	- 3,29
	7 (12%	100	95,77	- 4,23
	8 (12%	100	95,69	- 4,31
	9 (12% C)	100	97,51	- 2,49



Picture 1 – Changes of composition of the slag

III Conclusion

The subject of experimental monitoring was the problem connected with high-temperature re-melting processes of slags. It was necessary to stipulate the conditions for high-temperature processes based on monitoring of volume changes by the method of pattern analysis under high temperatures. The above-mentioned method then made the characteristic temperature points more precise and these points were needed for further process of decision making. This method also specified other conditions for conduct of the experimental laboratory test.

An extensive file of results has been obtained. These results document possible course of processes of re-melting of individual slags as well as qualitative changes that occur. Thus it becomes an indispensable help in case of practical application in conditions of metallurgical operation.

Literature

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