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EXPERIMENTS AND RESULTS REGARDING THE USE OF FOAMED SLAGS AT THE STEEL ELABORATION IN ELECTRIC ARC FURNACES

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ABSTRACT: In paper is presented a synthesis of results obtained of authors regarding to reinsertion in the economic circuit of scrap and pulverous waste existing in Hunedoara area.
Through these capitalization of wastes in the iron and steel industry I done substantial economies in cost-price of final product, on aside, and but the other side are in progress an ecological process of environment Hunedoara area through give back of occupied surfaces with these waste to the natural frame.
KEYWORDS: Pulverous wastes, briquette, steel plant dust, agglomeration-blast furnace sludge, lime dust

❖ INTRODUCTION

Use of steelworks dust from steel production or as a mechanical mixture or as micropelets (even pellets) as a slag foaming agent to believe that technology is the optimal solution for the use of these wastes. Simultaneous processing of waste containing iron powder and waste containing carbon powder to obtain a product suitable for use in various stages of technological flux led to the development process of obtaining a product called CARBOFER ® .

Data from literature and those obtained from their experiments, CARBOFER recommended as a substitute for the official site of slag foaming in electric arc furnaces, no influence chemical composition of steel and slag.

❖ THE STUDY

In order to achieve phase laboratory experiments, we collected samples from several sections powdery waste of ArcelorMittal steel platform and storage ponds, being collected representative samples of the following types of waste: electric steelworks dust; - scale and dump the dross; the agglomeration, blast furnace dust (sludge agglomeration-blast); lime powder. Each waste sample was subjected to the operation of mixing (the homogenization was processed drum). Evaluating the quality of waste powder, determinations were made of physicochemical characteristics, namely: chemical composition and size. Experiments on the production site CARBOFER were conducted in the laboratory energy and raw materials base of the Faculty of Engineering of Hunedoara.

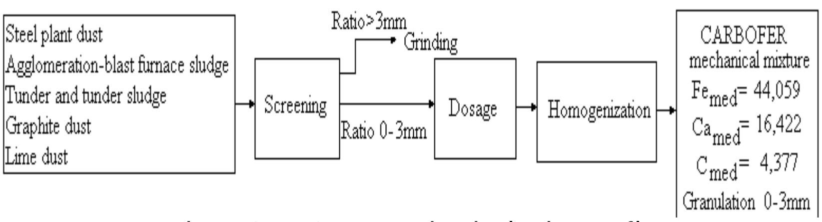


Fig.1. CARBOFER mechanical mixture flux

Fig.2. Example CARBOFER mechanical mixture

CARBOFER production powdery mixture flux, processing took place after the technological shown in Figure 1, Figure 2 is presented in such a recipe. I experienced a total of 10 recipes with chemical composition in Table 1. Also, for those recipes we determined size composition, presented in tabular and graphic tab.2 in fig.3.

Tab.1. The chemical composition of the mixture mechanically CARBOFER

Recipes no.	The chemical composition, [%]										
	SiO_2	FeO	Fe_2O_3	P_2O_5	S	C	Al_2O_3	CaO	MgO	MnO	other oxide
R1	4,65	4,88	39,93	0,10	0,56	23,55	3,72	9,13	1,11	1,22	11,14
R2	4,25	4,97	43,82	0,09	0,50	22,67	3,36	7,75	1,00	1,24	10,36
R3	3,86	5,05	47,70	0,09	0,44	21,78	3,00	6,36	0,88	1,26	9,58
R4	3,47	4,96	51,74	0,09	0,39	17,96	2,64	7,87	0,81	1,40	8,66
R5	3,07	5,04	55,67	0,09	0,33	17,07	2,28	6,49	0,70	1,43	7,84
R6	2,67	5,13	59,57	0,08	0,28	16,19	1,92	5,11	0,58	1,45	7,04
R7	2,29	5,10	63,51	0,08	0,22	13,34	1,56	5,65	0,50	1,54	6,21
R8	1,89	5,18	67,44	0,08	0,17	12,46	1,20	4,27	0,38	1,57	5,39
R9	1,50	5,14	71,44	0,08	0,11	9,61	0,84	4,81	0,29	1,67	4,51
R10	1,50	5,22	72,30	0,08	0,11	9,61	0,83	3,85	0,28	1,67	4,55

Tab.2. Product classification CARBOFER granulometric class

Recipes nr.	Granulometric class, [mm] / Share, [%]						
	3,0-1,0	1,0-0,75	0,75-0,45	0,45-0,315	0,315-0,25	0,25-0,18	0,18-0
R1	6,325	39,975	24,93	14,75	6,135	4,25	3,635
R2	10,625	37,2	24,433	14,083	6,031	4,221	3,407
R3	14,925	34,425	23,936	13,416	5,927	4,192	3,179
R4	14,7	30,795	24,485	15,807	6,358	4,485	3,37
R5	17,22	28,23	24,65	15,96	6,252	4,52	3,168
R6	20,63	25,56	24,484	15,703	6,147	4,523	2,953
R7	23,99	21,97	23,912	16,118	6,402	4,634	2,974
R8	26,51	19,405	24,077	16,271	6,296	4,669	2,772
R9	27,2	16,13	24,498	17,916	6,548	4,876	2,832
R10	28,09	16,175	24,325	17,239	6,54	4,865	2,766

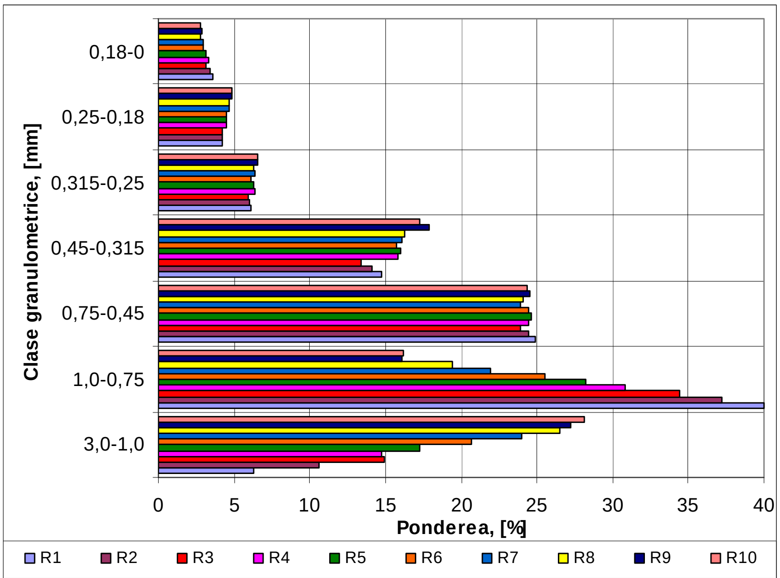


Fig.3. Product classification CARBOFER granulometric class

DISCUSSIONS

CARBOFER product - mix engineer, the first stage, we sampled from the 10 recipes tested in laboratory conditions, samples were analyzed at SC CCPPR SA Alba Iulia.

For each recipe there was a quantity of 2kg of powdered mechanical mixture, which was melted in an induction furnace melts Metal fitted Laboratory of the Faculty of Engineering of Hunedoara. After having analyzed the behavior of each recipe were chosen as representative recipes R1 and R5 (to continue industrial experiments), obtained by using various waste materials both ferrous and addition chemistry of recipes (calculated and determined) is tab.3 presented.

Bulk density was determined only for the two recipes are selected for subsequent experiments, results are presented in tab.4

Tab.3. Chemical composition of tested recipes industrial

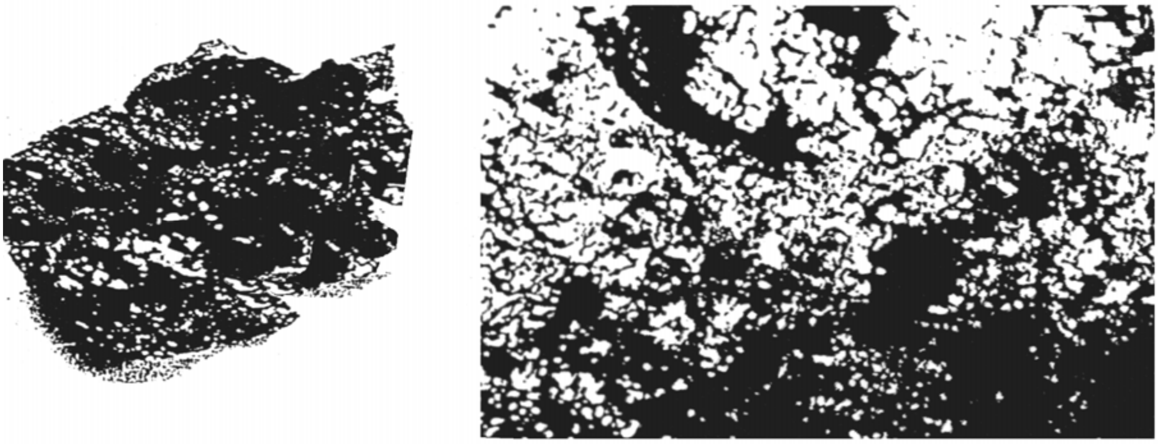
Recipe nr.	Chemical composition, [%]										
	SiO_2	FeO	Fe_2O_3	P_2O_5	S	C	Al_2O_3	CaO	MgO	MnO	other oxides
calculated											
R1	4,65	4,88	39,93	0,10	0,56	23,55	3,72	9,13	1,11	1,22	11,14
R5	3,07	5,04	55,67	0,09	0,33	17,07	2,28	6,49	0,70	1,43	7,84
determined											
R1	4,72	-	40,07	-	-	-	3,81	9,52	1,23	-	16,43
R5	3,22	-	52,68	-	-	-	2,67	7,14	0,71	-	15,7

Tab.4. CARBOFER product bulk density, mechanical mixture

Density, [kg/dm^3]	Recipe no.	
	R1	R5
	0,8854	1,1150

To determine the foaming capacity, slag samples taken were investigated in terms of macroscopic and microscopic appearance.

The analysis was done by examining the macroscopic appearance of virtual samples and conducting clay-sized photographs (Fig. 4 and 5), all recipes slag formed is uniform porosity and the pores are smaller (especially in cases where the height of the slag foaming was smaller and less intense) respectively standard slag (fig.6).



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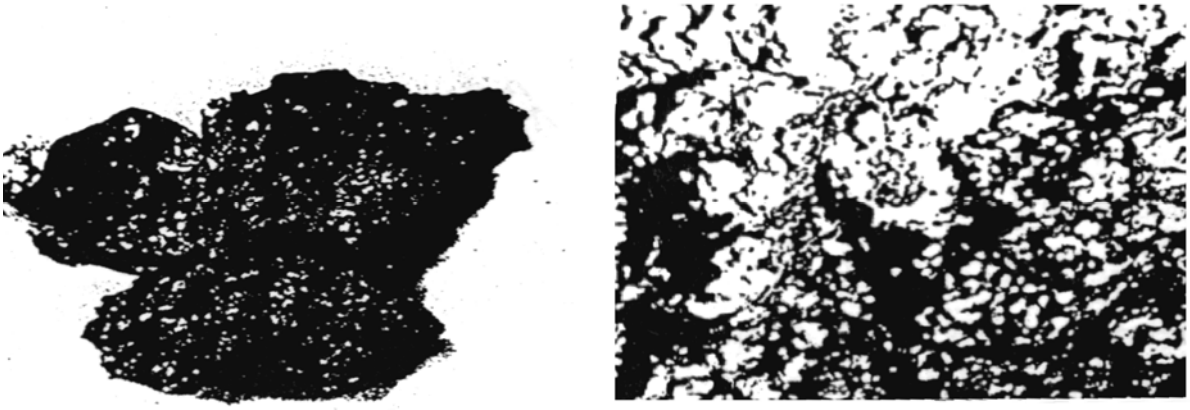
Macroscopic appearance-slag — Microscopic appearance-slag

Fig.4. The physical characteristics of slag and addition of product standard CARBOFER (R1).



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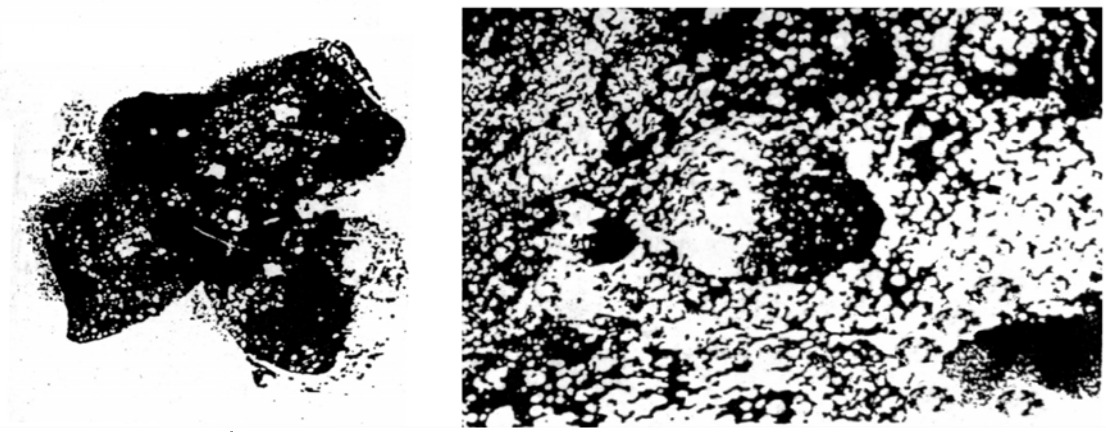
Macroscopic appearance-slag — Microscopic appearance-slag

Fig. 5. The physical characteristics of slag and addition of product standard CARBOFER (R5)



Size — x10

Macroscopic appearance-slag — Microscopic appearance-slag

Fig. 6. The physical characteristics of standard slag

❖ CONCLUSION

Experiments performed revealed that the product CARBOFER added a foaming slag with good capacity, leading to foaming phenomenon. There was a difference in the intensity of the two products CARBOFER frothing; foaming is more intensive use after the first prescription product.

Product CARBOFER use as a substitute for the usual agents of slag foaming in electric arc furnace has both an environmental benefit and economic one. Environmental benefits are shown by a significant reduction in environmental pollution, namely by increasing recovery of waste powder and reducing these waste storage facilities. The economic advantage is the immediate transfer of costs for waste disposal in the UK which are between £ 30-57 / t waste stored to other destinations.

❖ ACKNOWLEDGMENT

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