ACCOUNTING POSSIBILITIES OF FERROUS WASTE FROM HUNEDOARA ZONE - ROMANIA

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ABSTRACT

In the area of Hunedoara important quantities of ferrous waste resulted from fabrication processes of siderurgical products (cast iron, steel, blank of steel) are deposited in dumps and dams. This waste must be reintroduced into the economical circulation because they represent a raw material source and for reduction of pollution grade of environment at air-water-soil level.

In this paper are presented the results of researches concerning utility of powder ferrous waste used at production of unsintered bodies for blast furnace charge and of necessary materials for slag frothing at EBT furnaces.

Keywords: *air-water-soil, ferrous waste, dumps and dams, raw materials, environment, reduction of pollution grade, Hunedoara area*

1. INTRODUCTION

From a quantitative point of view steel is ranked on the first among metallic materials produced in Romania even if there has been a major reorganization of the siderurgical industry, one of it's consequence being the reduction of steel production with approx. 50%. In fact in any country with a developed industry from the mentioned point of view steel is on the first place in the entire world.

Beside the great utility properties steel is distinguished through the possibility of recycling. The recycling operations are greatly facilitated by the magnetic properties. In the industrially developed countries (in which the ferrous materials recirculate much faster in time) the steel produced out of old iron constitutes 40 – 50% of the total quantity of steel – there are differences from one country to another, as well as, in the same country, from one company to the other.

To produce one tone of steel it is necessary to have a medium of two tones – raw materials, as well as auxiliary materials, including reducting materials. Considering the processing of large quantities of such raw materials, auxiliaries and reducting materials, there is also a considerable quantity of wastes. For example, at the TKS company's factory in Duisburg, in year 2000, the quantity of re-usable wastes was 1.1 million tones, or compared to the steel production, 110 kg per tone. This quantity refers to wastes for external delivery. Internally, much larger quantities are in discussion, and they are re-used as valuable raw materials in the appropriate equipments.

Taking into account the study above, we put into practice a series of testing which had as purpose the producing of briquettes out of pulverous, ferrous and basic materials. The materials that were used and their characteristics are presented in table 1.

Table 1. *The Chemical Composition of the Steel Dust and of the Ferrous Concentrate in the Thermal Power Station Dust [%].*

	The Chemical Composition, [%]									
Ferrous Wastes	*Fe_2O_3*	*FeO*	*%Fe total*	*SiO_2*	*Al_2O_3*	*CaO*	*MgO*	*MnO*	*P_2O_5*	*Other oxydes*
Steel Plant Dust	*90,03*	*1,57*	*64,71*	*1,25*	*0,25*	*0,45*	*0,15*	*4,57*	*0,3*	*1,70*
Thermal Power Station Dust Concentrate	*51,96*	*13,39*	*46,71*	*11,89*	*8,85*	*7,31*	*3,85*	*1,25*	*0,07*	*1,93*

Table 2. *The Grain Composition of the Steel Plant Dust and the Thermal Power Station Dust Concentrate, [%]*

Ferrous Wastes	*below 0,5µm*	*0,5-1,0µm*	*1,0-1,5µm*	*above 1,5 µm*
Steel Plant Dust	*11,23%*	*67,48%*	*12,52%*	*8,77%*
Thermal Power Station Dust Concentrate	*12,02%*	*68,68%*	*13,42%*	*6,58%*

Table 3. *The Chemical Composition of the Wastes Resulting from Preparing the Ores Through Roasting, [%]*

Materials	*The Chemical Composition, %*							
	SiO_2	*FeO*	*Fe_2O_3*	*Fe*	*Al_2O_3*	*CaO*	*MgO*	*MnO*
Waste Pond Clarifying	*34,39*	*7,01*	*7,84*	*9,12*	*2,87*	*16,39*	*6,68*	*1.35*
Concentrate	*19,86*	*9,92*	*18,64*	*21,03*	*3,16*	*20,22*	*7,56*	*2,29*
Sterile after concentration	*37,60*	*6,30*	*5,58*	*6,45*	*2,87*	*15,16*	*6,58*	*1,41*

Table 4. *The Chemical Composition of the Agglomerating and Furnace Dust, [%]*

Material	*The Chemical Composition, %*										
	SiO_2	*FeO*	*Fe_2O_3*	*Fe*	*P*	*S*	*C*	*Al_2O_3*	*CaO*	*MgO*	*MnO*
Ferrous Waste Agglomerating Furnaces	*8,41*	*7,12*	*26,45*	*25,86*	*0,11*	*1,11*	*17,7*	*7,11*	*8,43*	*2,02*	*0,71*

Table 5. *The Chemical Composition of the Iron Scale, [%]*

Material	*The Chemical Composition, %*										
	SiO_2	*FeO*	*Fe_2O_3*	*Fe*	*P*	*S*	*C*	*Al_2O_3*	*CaO*	*MgO*	*MnO*
Ferrous Waste Agglomerating Furnaces	*8,41*	*7,12*	*26,45*	*25,86*	*0,11*	*1,11*	*17,7*	*7,11*	*8,43*	*2,02*	*0,71*

These materials were processed using the recipes presented in table 6. and a mixture of lime, cement and furnace slag as binding agent.

Table 6. *The Recipe's Composition, [%]*

Materials	*No. of Recipe's*			
	1	*2*	*3*	*4*
Steel Plant Dust	*30*	*40*	*40*	*40*
Furnace Dust	*15*	*15*	*10*	*15*
Spathic Concentrate	*10*	*5*	*5*	*5*
Ferrous Concentrate on the Thermal Power Station Dust	*5*	*5*	*0*	*0*
Iron Scale	*20*	*10*	*18*	*27*
Chip	*2*	*2*	*7*	*0*
Fine Coke	*2*	*2*	*3*	*3*
Lime Dust	*5*	*5*	*7*	*2*
Dolomite Dust	*2*	*1*	*2*	*0*
Cement	*6*	*7*	*7*	*6*
Furnace Slag	*2*	*2*	*1*	*2*
Total	*100*	*100*	*100*	*100*

The fine coke addition has the role of ensuring the reduction of ferrous oxides, in fact completing this process together with the carbon from the furnace dust.

The lime, cement, furnace slag addition has the role of binding the components and hardening the briquettes. To ensure a higher resistance of the briquettes, an addition of the chip is necessary.

The hardening of the briquettes takes place in the air, after a period of ten days an adequate hardening is to be noticed, therefore a fall from a height of two meters causes no destruction.

Due to objective causes, the production and testing of the briquettes was possible only in laboratory conditions.

The research was performed at the Tamann furnace in the "Steel Laboratory" of the Faculty of Engineering in Hunedoara, in a process containing four meltings (one for each recipe). The charge of the melting pot has the following composition, presented in *table 6*.

Table 7. *Components of The Experimented Charges*

No. Criteria	*Components of Charges*	*Weight, g*
1	** Ferrous Waste Powder*	*300*
2	*Briquette*	*100*
3	*Fluorite*	*20*
4	*Lime*	*30*
5	*Fine Coke*	*10*
6	*Total*	*460*

** laboratory samples from "Siderurgica" Company – Hunedoara*

During the melting, a foaming of the slag was noticed, and this was intense than in the case of using briquettes produced with the first recipe. This fact is explainable with the use, in this case, of a larger concentration of spathic concentrate, which contains calcium carbonate and undissociated magnesium. The dissociation releases CO_2, which causes the foaming of the slag.

In all the cases, the reduction of ferrous oxides was very good, the resulting slag having a light colour, which is typical for slags with low contents of ferrous oxides.

5. CONCLUSIONS

From the data presented in the studies written on this subject, as well as from the testing, we reached the following conclusions:

- the pulverous ferrous wastes and those with basic characteristics be re-introduced into the economical circulation from siderurgy;
- the pulverous ferrous wastes can be processed either through pelletising or through briquetting;
- the composition of the recipes will be established according to the pulverous waste at disposal and to the destination of the processed materials for steeling;
- in obtaining pellets for steeling, the granulation of wastes (steel plant dust, furnaces dust, concentrates) raises no problems – than can be used as they are without undergoing a classifying process;
- with the local conditions, we consider an intensification of the recovery process for the wastes to be necessary, on one side because of their status as an iron source, a raw material in deficiency, and on the other side out of technological reasons;
- the wastes deposited in ponds and dumps can be recovered also.

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