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ANALYSIS OF THE EAF METAL CHARGE STRUCTUREOF REMOVAL OF LIQUID STEEL TO ELECTRIC OVENS EBT TYPE

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Abstract: Homework work deals with a matter of great topical interest in the production of steel namely optimization to obtain steel using the electric arc furnaces with an alternating current, having regard to that, in the present, world–wide, over 40% of the steel weight is obtained in the electric arc furnaces, a fact that leads to a high consumption of electrical energy and produce powerful quality disturbances to electrical energy delivery to customers in the vicinity of these ovens. The paper presents the results of analyzing the structure of the charge intended for ultra–high power EAFs, with eccentric bottom tapping (E.B.T.), 100 tonnes capacity. In the cases we have studied, the charge consisted of scrap (types: E1, E2, E5, and E100), internal & purchased ferrous skulls, and ferrous materials from internal recycling & disposal. We monitored 96 heats, analysing the structure of the metal charge, the additives introduced directly in the metal charge throughout the steelmaking process, the propellant materials and the oxygen blown into the metal bath. The results are shown in graphical form, based on which we made a technological analysis, presented in this paper.
Keywords: steel, electric arc furnaces, ultra–high power EAFs, eccentric bottom tapping (E.B.T.), charges

1. INTRODUCTION

Metal load of the furnace with electric arc consists primarily of scrap iron. In many steelworks is used and the foam of iron. In the framework of such experiments carried out in an oven EBT type 100 tonnes was used only scrap iron of different kinds [1].

It has been an analysis of raw materials necessary for the production of steel. For economic reasons is justified the need maximize amount of steel products from scrap metal, the constraints related to the environment is also important, the production of steel waste allows significant reductions in air pollution (about 86%), in the volume of water used (40%), water pollution (76%) and of mining waste results (97%).[2] Directive on eco–design makes it possible to identify the requirements for recycling capacity and stripping of the products cost–effective way which will ensure a better access to the pieces of metal. [3]

It is intended to identify some technology upgrades and the possibility for their implementation in the production units which are aimed at reducing energy costs, the costs of raw materials used in the production of the hotel. Steel industry is one of the biggest sources of C02 emissions (it is estimated that in the EU–27, between 4% and 7% of anthropogenic emissions of C02 from this industry, which has generated an average 252,5 tons of C02 emissions during the period – 2008).[4] Technical Development has determined, however, the increase in so far as much of the sources of "scrap iron", by taking out of operation of machinery, plant, plant, metal buildings, means of transport, etc., worn physical and moral category and by larger quantities of scrap manufacturing (as a result of the increase in production), with the result that steel is drawn up to a large extent from the "scrap iron". By reintroduction into the productive of iron, recirculate not only iron, but also alloying elements and the harmful. For this reason, in stainless steel, in addition to the factors prescribed, aimed to ensure quality steel requested by requirements on the use, I get up there and foreign elements, also known as a rule that "waste". [5,6,7].

In these new technological conditions particular importance has structure and quality metal load both chemical composition, its origin, the degree of preparation of the load.

2. STUDY OF THE PROBLEM

Given theabove, for the analysis of the charge structure we monitored 98 steel heats made at an electric furnace steel plant equipped with an electric arc furnace of EBT type and a continuous casting plant with 5 strands, the semi–finished products obtained being blooms, billets and round profiles.The parameters monitored at those 98 steel heats, intended to produce steel tubes, were:

- components of the metal charge: scrap (types: E1, E2, E5, E100), internal and purchased ferrous skulls, scrap from internal recycling or disposal;

- auxiliary materials for slag formation: dolomite, foaming material, coke, Topex Ca, Topex;
- additives for the refining process: lime, graphite, carbon (injectors), oxygen (injectors), oxygen (lance), gas (injectors);
- additives for the deoxidation process: ferro–manganese, ferro–silicon and ferro–silico–manganese;
- duration of the technological stages until tapping (included);
- electrical energy consumption;
- limits of variation and average values for the monitored parameters;
- content of trace elements unusable as alloying elements at the end of the melting stage;
- content of trace elements that can be used as alloying elements at the end of the melting stage;

During the steelmaking process, the charge structure was carefully monitored, along with its dimensional appearance and slag content, either concerning the internal steel skulls (collected from the slag dumps) or purchased. Also, we visually appreciated the quality of the prepared scrap (E1, E2, E5, and E100) and the scrap originated from disposals, concerning the content of rust, nonferrous metals, soil, sand, etc.

Below, we graphically presented the obtained results, based on which we performed a technological analysis of the conducted research.

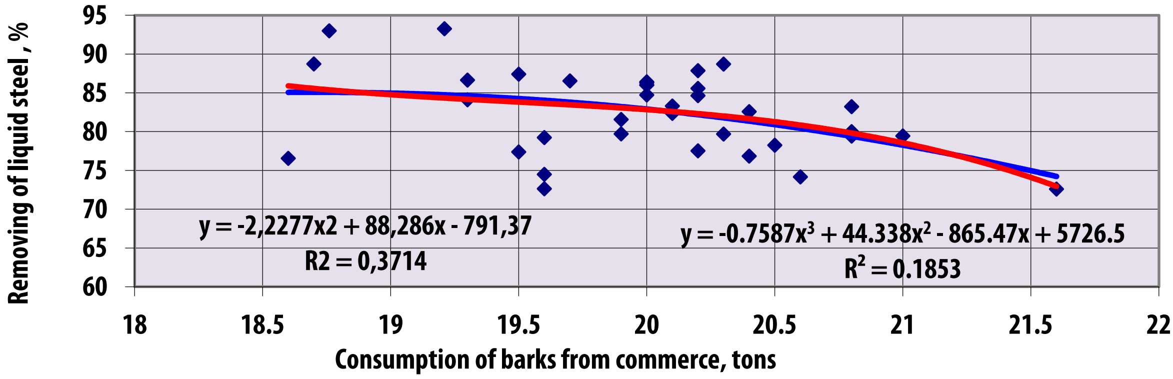

Figure 1. The variation of removal of steel on the basis of the quantity of barks from commerce

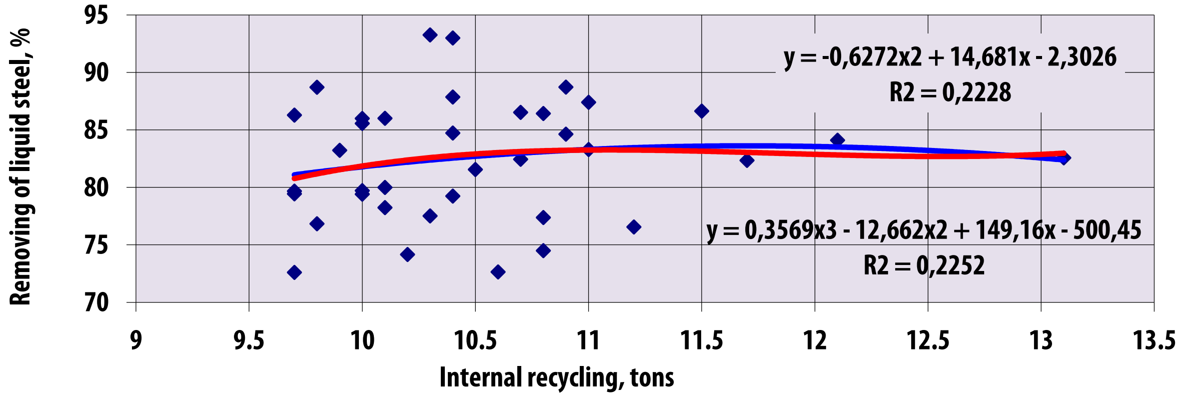

Figure 2. Variation of removal of steel on the basis of the quantity of scrap iron from internal recycling

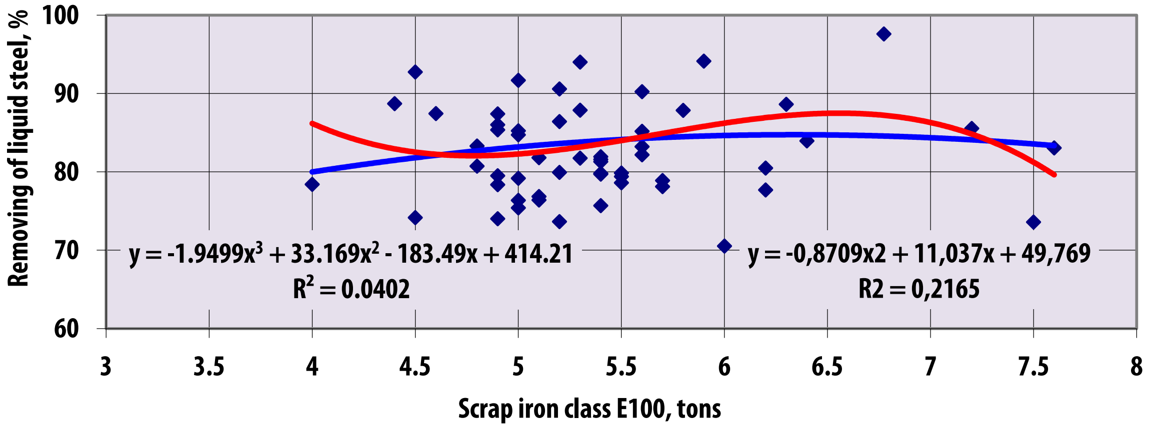

Figure 3. Variation of removal of steel on the basis of the quantity of scrap iron class E100

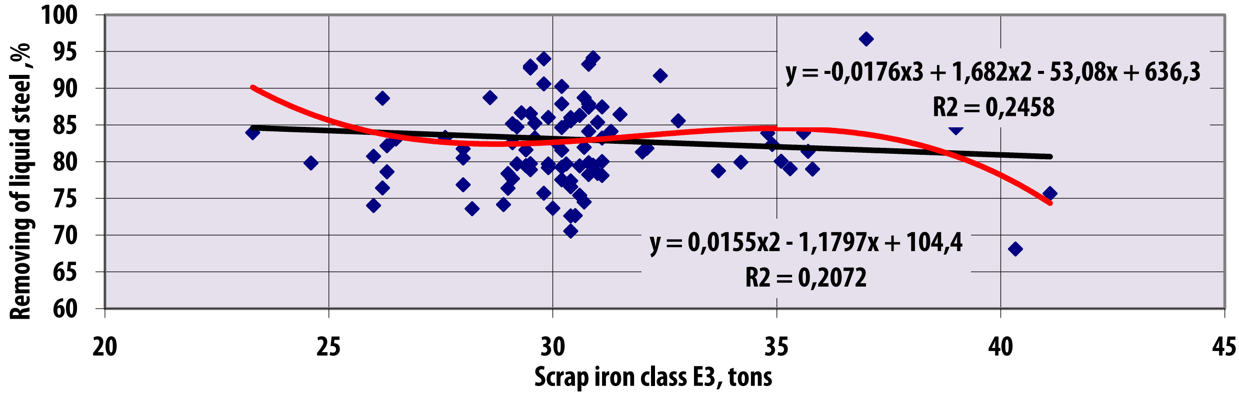

Figure 4. Variation of removal of steel on the basis of the quantity of scrap iron class E3

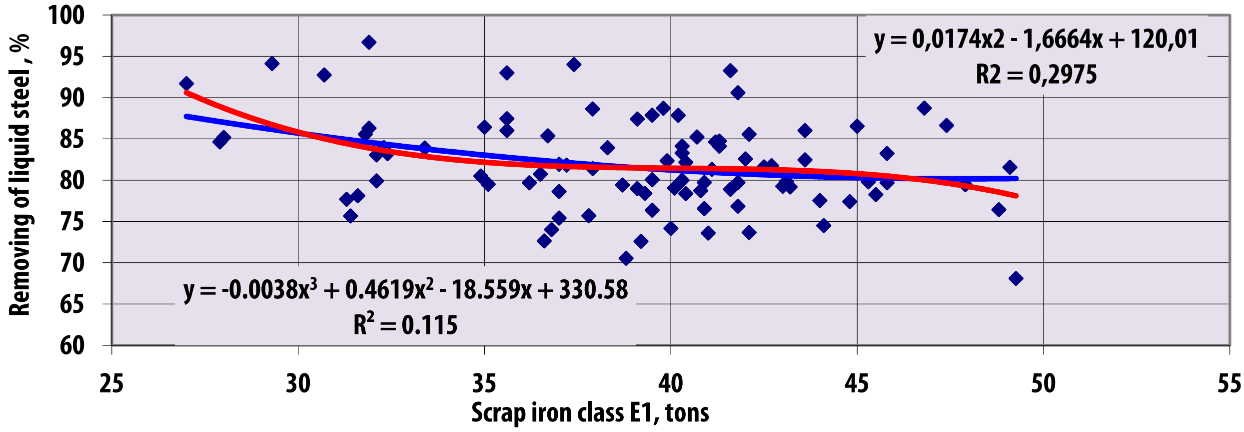

Figure 5. Variation of removal of steel on the basis of the quantity of scrap iron class E1

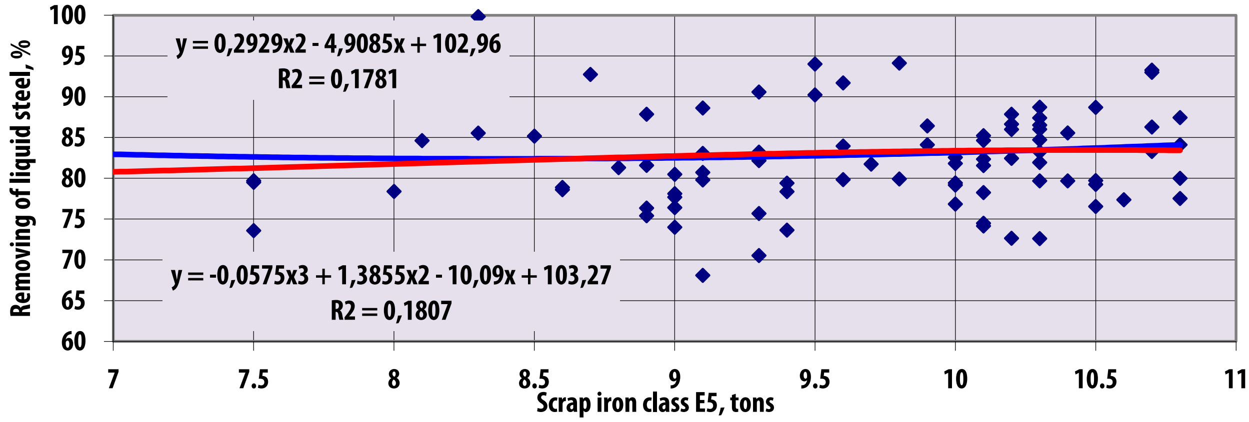

Figure 6. Variation of removal of steel on the basis of the quantity of scrap iron class E5

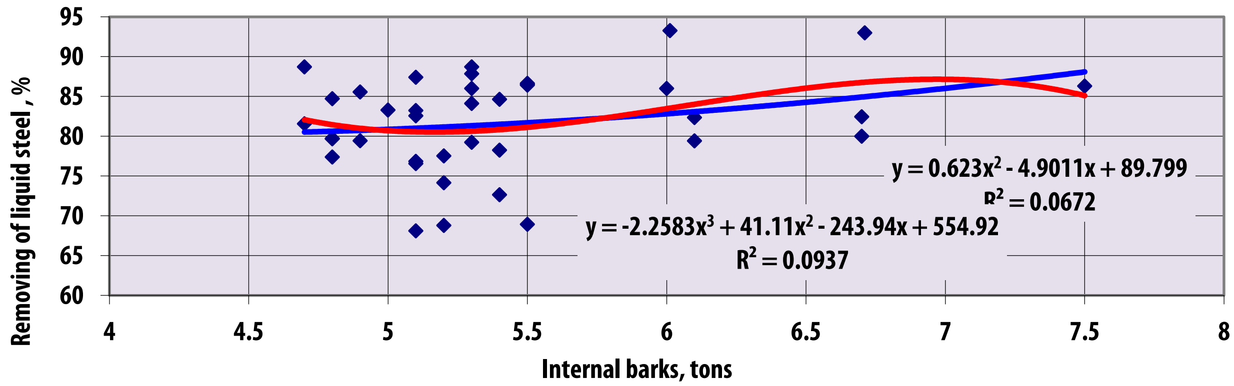

Figure 7. Variation of removal of steel on the basis of the quantity of ferrous internal barks (less than 8t/batch)

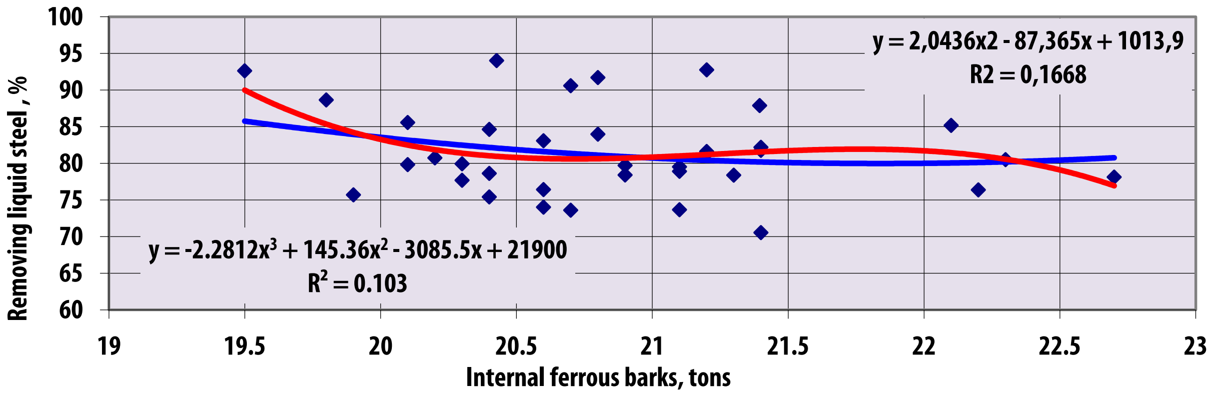

Figure 8. Variation of removal of steel on the basis of the quantity of ferrous internal barks(19–23t/batch)

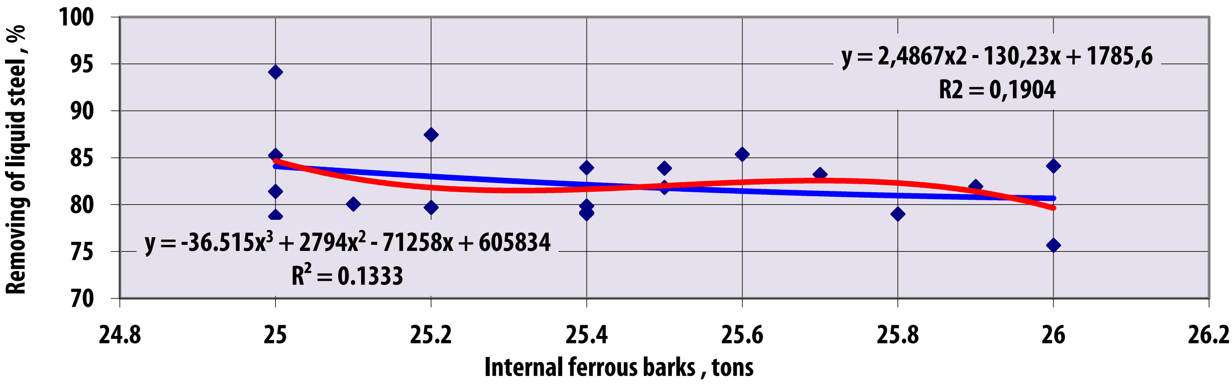

Figure 9. Variation of removal of steel on the basis of the quantity of ferrous internal barks(24–26t/batch)

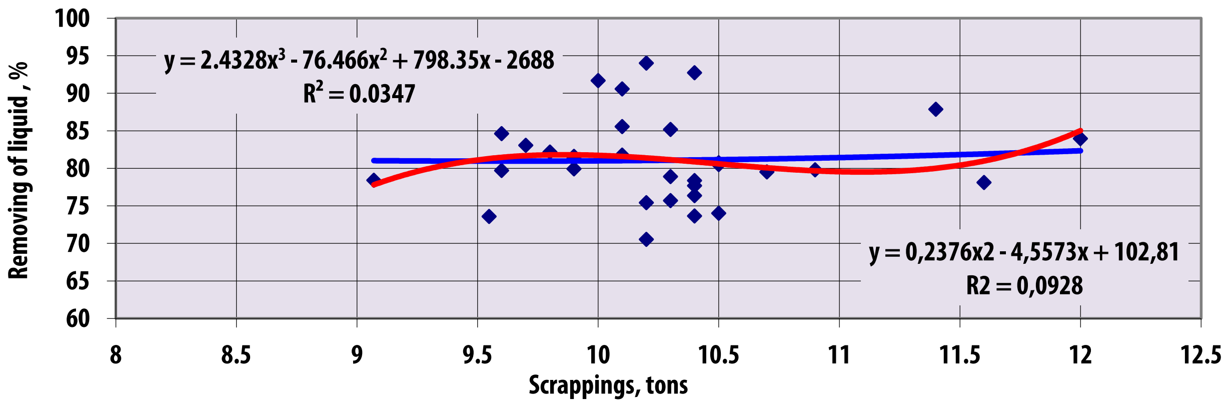

Figure 10.Variation of removal of steel on the basis of the quantity of scrap iron from scrappings (8–12t/batch)

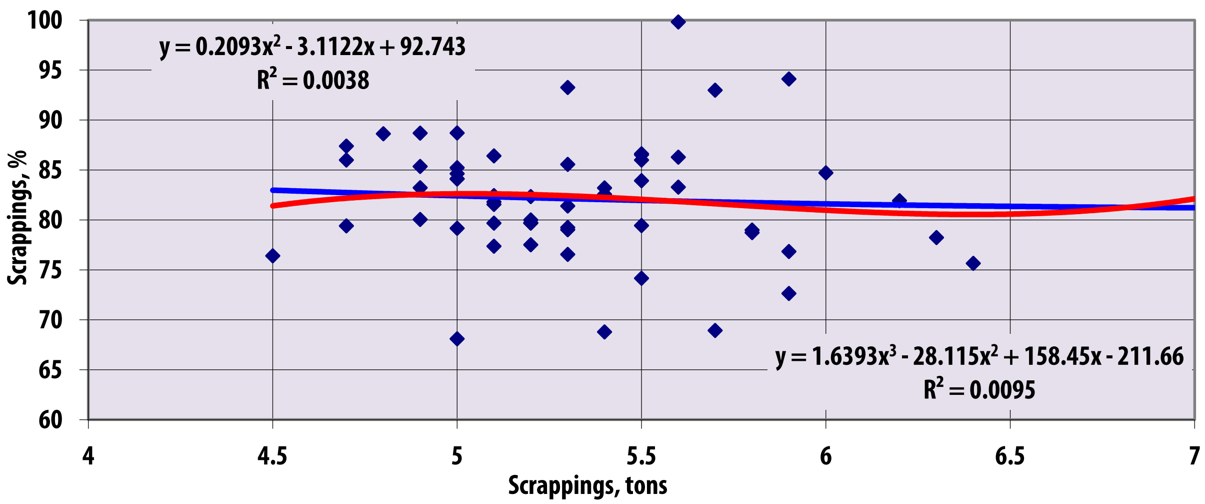

Figure 11. Variation of removal of steel on the basis of the quantity of scrap iron from scrappings (4–7t/batch)

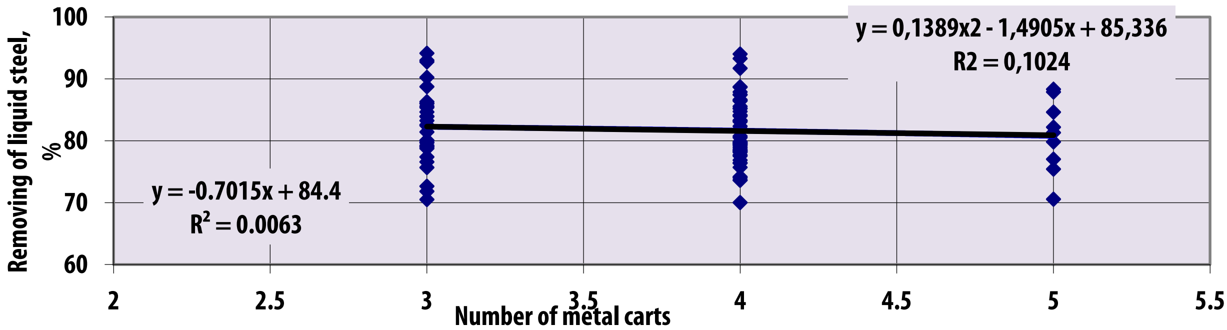

Figure 12. Variation of removal of liquid steel depending on the number of metal carts loaded in the oven

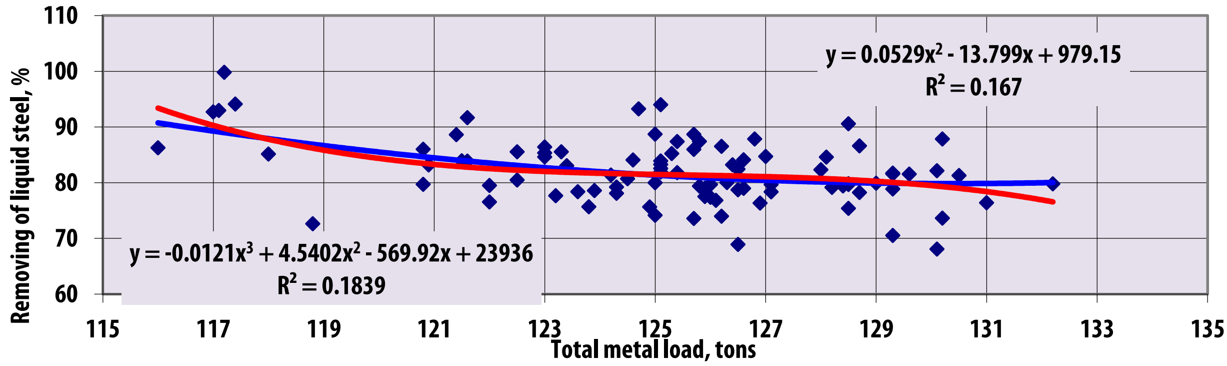

Figure 13. Variation of removal of liquid steel depends on the weight of the load metal

3. TECHNOLOGICAL ANALYSIS

The following technological aspects resulted from the technological analysis of the graphical charts presented in the figures 1–13:

- in Figure 1 it is observed a decrease in the removal of liquid steel because of the growth of consumption scoarte originating in commerce, main reason being the impurities content of the latter in particular dross and sometimes scrap of refractory materials and is not indicated increase what proportion of this grade above 20 %;
- in Figure 2 and Figure 3 there is a slight increase of removal of liquid steel up to a proprtie approximately. 11T/1 batch internal recycling, respectively 6t/batch scrap iron E100 after which remains constant, which is partly due purity of these varieties:
- in Figure 4 and Fig 5 is a slight decrease in growing scosterii sorts of weighting of the scrap iron E1 and E3, are not shown exceeding the proportion of 40 %;
- Figure 6 emphasizes the fact that removing steel licid is not significantly influenced by the proportion of scrap iron class E5 within the limits of 7–11%
- of the influence of the quantity of assorted bark internal metal used in load on metal removal of liquid steel is shown as follows: in Figure 7 to a metal load up to 6–7 tons of internal out there is an increase in the removal of steel, a fact explained by an increase in other kinds of scrap iron with a low non–metallic components; a larger quantity of bark decreases removing internal metal steel,
- in Figure 8 and Figure 9 there is a slight decrease in the removal of steel determined by the content of the slag this type;
- related to the quantity of material from disposals and used In oven load can be ascertained from Figure 10 and Figure 11 that it does not have a significant influence, as a slight decrease of removal, which can be caused by preparing neavansata (dimensionally sort by chemical composition etc) of this grade;
- the data of Figure 12 recommends that the loading your oven to be carried out in 2–3 up to 4 bene, what technology means that we have a load of good quality, advanced pregarita from the point of view dimensional space, the specific weight, of non–ferrous materials etc;
- from Figure 13 it is found that an increase in the load weight to be particularly over 120 t will lead to a reduction in the release because this increase is due to the large share of ferrous metals with relatively low content of iron;
- analysis of metal structure of the kiln load it is to be noted that an increase in the quantity of bark will lead to a reduction in the disposal of liquid steel, it is recommended that scrap iron to be as far as possible ready, the load Metal to be more compact, which recommended that a quantity of bark as low.

The analysis performed showed the influence of the metal charge structure and quality on the steelmaking process, and the justification for extending the results throughout the manufacturing process.

4. CONCLUSIONS

The electric arc furnace of EBT type is the most appropriate unit for processing scrap in order to obtainsteel, both in terms of charge quality and the number of scrap assortments introduced in the charge;

It isnecessaryto observe themeteringrecipe of iron, in thestructurelaiddown in theinstructionscommontechnological, for theoperation electric arc furnace, 100 t type EBT;

Stitching metal loadelectricalfurnace must provide: compactness as high for judicioususe of theworkingarea in questionprotect Vatra Romaneasca, wallsand of a dome of the impact of heavypieces of scrapiron at thetime of loadingandthe electric arc radiation.

- demand for scrapironisnotcovered in full;
- scrapironfromrecircularidoesnotraiseanydifficultiesfromthepoint of view of sorting on alloyingelementsandnoqualitative, becauserecirculation period isrelativelyshort. thiscategorydoesnotcover but societyneeds, as they are about. 20 %;
- scrap iron collected raised a number of issues in the first place due to the fact that there is no control of collection and sorting of the alloying elements and secondly because its impurificarii non–ferrous materials, non–metallic materials, concrete, earth, etc;
- due to the fact that, in quantitative terms, it is not guaranteed quantity of scrap iron required to operate electric ovens with a spring with a high efficiency, the time required for preparation it is very short and because of this load is not appropriate (both in terms of quality as well as the degree of compactness);
- the charge structure may vary within wide limits in termsof assortment, provided to be advanced prepared;
- the metal charge weight varied within wide limits due to the variation in the share of different assortments of scrap;
- the scrap assortment structure did not result in exceeding the content of trace elements that could lead to heat downgrading;
- the quality of scrap and skull is reflected in the yield;
- in practice, the charge quality is also determined by economic considerations, who are depending on the steel grade, which obviously varies from one steel plant to another.

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