Study Regarding the Factors Influencing the Dynamics of Solid Waste in the Steelmaking Process

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Abstract. Knowing the factors that determine the dynamics of solid waste generation is very important because it provides clues about possible alternatives to reduce the quantities of generated waste. The purpose of this paper is to identify the factors that affect the dynamics of solid wastes generation in the steelmaking process in electric arc furnaces. Fig. 1 presents the main factors influencing the dynamics of solid waste generation during steelmaking in electric arc furnaces. The annual steel production is the factor that has the greatest influence on the dynamics of solid waste from steelmaking in electric arc furnaces. If the annual production of steel is higher, the quantities of solid waste generated will be higher.

Keywords: metallurgical wastes, pollution prevention, steelmaking, slag, dust.

Introduction. The understanding of the factors that determine the dynamics of solid waste generation is very important because it provides clues about the possible alternatives to reduce the quantities of generated waste.

According to existing literature, for each tonne of steel elaborated in the electric arc furnaces, it results in average 150-200 kg of waste (Cheremisinoff, 2003). The solid wastes from steelmaking in the electric arc furnaces are dust and slag.

In (Table 1) is presented total production of crude steel in the world.

Tab. 1

Total production of crude steel in the world

Year	2008	2009	2010	2011
Production of crude steel (thousand tonnes)	1329021	1224024	1428711	1490060

(WSA, 2010; WSA, 2011)

The understanding of the factors influencing the dynamics of solid waste generation will help to identify the measures that can be taken to reduce the amount of solid waste generated in steelmaking, and reduce the negative impacts on the environment factors.

Aims and objectives. The aim of this paper is to identify the factors that affect the dynamics of solid wastes generation in the steelmaking process in electric arc furnaces.

The goal of this paper is to identify the possibilities to minimize the quantities of solid wastes generated during the steelmaking based on the knowledge of the factors influencing the dynamics of the solid wastes.

Materials and methods. The identification of the factors influencing the dynamics of the solid wastes was realized based on the data supplied by (WSA, 2010; WSA 2011) and those existing in the literature.

Results and Discussion. Fig. 1 presents the main factors influencing the dynamics of solid waste generation during steelmaking in electric arc furnaces.

The annual crude steel production is the factor that has the greatest influence on the dynamics of solid waste from steelmaking. If the annual production of steel is higher, the quantities of solid waste generated will be higher.

The contamination degree of charge components is another factor that influences the quantity and quality of solid waste generated during steelmaking. If in the charge there are compacted metal materials, recovered from refrigerators, cars, trucks, household appliances, these may contain plastics, nonferrous metals, putty, lead-based paints, materials that have been subjected to metal coating, etc. As the degree of charge contamination is higher, the amount of waste generated will be higher.

The melting methods are (Nagy, 2000): with complete oxidation, with partial oxidation and without oxidation. The largest quantities of solid waste are generated when using complete oxidation melting method, because the scrap used has an inferior quality (oxidized) and the smallest quantities of waste are generated if the method used is melting without oxidation, because the charge is composed mainly of un-oxidized waste.

The smallest amounts of solid waste are generated when making alloyed steels and high alloyed steels, because the charge must be clean, and the largest amounts of waste are generated when making carbon and low alloy steels, because one can use a lower quality charge. Other factors, presented in Fig. 1, have a lower influence on the dynamics of solid waste generation.
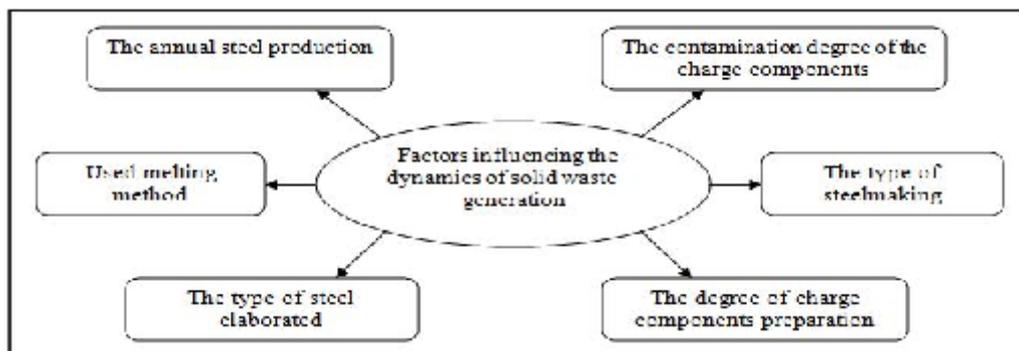

Fig.1. The main factors influencing the dynamics of solid waste generation during steelmaking process (original figure)

Conclusion. Identifying the factors influencing solid waste generation dynamics are particularly important in terms of understanding their parameters, through which it is possible to minimize the amount of waste, generated during steelmaking in electric arc furnaces.

The factors influencing the dynamics of solid waste generation during steelmaking are: the annual steel production, the contamination degree of charge components, the melting method used, the type of steelmaking, the degree of charge components preparation and the type of steel elaborated.

Minimizing the amount of solid waste generated during steelmaking is possible through a better selection of the charge components and by reducing their contamination.

ACKNOWLEDGMENTS

REFERENCES

1. Cheremisinoff, N.P. (2003). Handbook of solid waste management and waste minimization technologies. Elsevier Science, USA.

2. Nagy, E. (2000). Steelmaking in the electric arc furnace. Publishing George-Bariţiu, Cluj-Napoca.

3. ***World Steel Association (WSA), 2010. Steel Statistical Yearbook 2010. Brussels.

4. ***World Steel Association (WSA), 2011. Annual crude steel production. Brusse