ASSESSMENT OF TECHNICAL-ECONOMICAL DEVELOPMENT PERSPECTIVE OF SELECTED NON-FERROUS METAL POTENTIAL IN METALLURGY

PUSTĚJOVSKÁ Pavlína[1,2], BROŽOVÁ Silvie[1], JURSOVÁ Simona[2], KARDAS Edyta[3]

[1] VSB - Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, Czech Republic, EU, pavlina.pustejovska@vsb.cz, silvie.brozova@vsb.cz
[2] VSB - Technical University of Ostrava, Centre ENET- Energy Units for Utilization of non Traditional Energy Source, Ostrava, Czech Republic, simona.jursova@vsb.cz
[3] Czestochowa University of Technology, Faculty of Management, Czestochowa, Poland, EU, ekonstan@wip.pcz.pl

Abstract

The aim of the following article is to define measures to reduce costs in the metallurgical enterprises. One possibility is the usage of alternative materials - waste. In case of increasing requirements for cleanliness of products in metallurgy is necessary to take into account all sources accompanying elements from the entire course of the process. The main source of charge is mainly iron-bearing charge - mainly pig iron and steel scrap, further ferroalloys used in the production and fluxes. Therefore attention must be paid to the choice and particular sorting charge materials. Economic evaluation is directly related to new Act on Waste.

Keywords: Metallurgy, iron-bearing charge, economic evaluation

1. INTRODUCTION

Application of cost prices in an integrated metallurgical company is a natural way of business, because from the point of view of the whole company and its relation to the environment a global resulting economic effect is a decisive one. This effect reflects even influences of secondary products of technological process, such as blast-furnace gas and slag and/or treatment of other products (secondary raw materials from other processes, for example scales or wastes containing iron). The aim of the following article is to define measures to reduce costs in the metallurgical enterprises. One possibility is the usage of alternative materials - waste. The comparison of production of pig iron and steel in Czech Republic and Poland are mentioned in the following **Table 1.**

Table 1 The comparison of production of pig iron and steel in Czech Republic and Poland [1]

Production [thousand tons]	European Union	Czech Republic	Poland
Crude steel production	169 243	5 360	8 620
Iron production	95 088	4 152	4 651

2. METALLIC CHARGE AND QUALITY OF CHARGE BASE MATERIALS

Base materials consist of primary materials: (ores, sinter, ore extract, lime stone) and secondary materials (treated steel slag, scales with oil content up to 1%, flue dust emission), rough converter sludge (up to 1 mm), blast-furnace sludge, magnetic fracture, dust from agglomeration electro-separators.

Czech metallurgical plants purchase prevailing part of iron ores from the Ukraine and Russia. The main supplier states are as follows: the Ukraine - it supplies approx. 60 million tons per year and it is the main supplier for the Czech Republic. Russia supplies pellets first of all (Michajlovsky, Lebedinsky, with richness of 60-62% Fe).

A similar situation can be observed in Poland. The iron ore in the form of pellets are imported mainly from Russia and the Ukraine. The Poltava pellets are the most used, but also to a less extent, Mikhailovsky, Lebiedeńsky and Kostomuksha [2].

Steel scrap belongs to the "local" raw materials, the consumption in the Czech Republic is approx. 1.4 t per year but there are problems with its quality, it is also a commodity with the highest price fluctuation.

In Poland, the main suppliers of steel scrap are local junkyards. Widely extensive network of junkyards and scrap collection allows to use mainly Polish scrap. However, due to variations in the amount of scrap available on the market, as in the Czech Republic, the price of scrap constantly fluctuates [3].

Considerable part of wastes from metallurgical processes is used in other metallurgical processes as a charge material [4], some waste materials can be used also in other technological processes. More than 95 % of total waste in metallurgy is recycled, only 3.5% is eliminated and 1.3% temporarily stored which is connected with a specificity of this industry branch. Constantly tightening up legislative leads to necessary use of treated wastes, for example in the form of briquettes [4], even in Czech metallurgical companies [5].

Waste management legislative in the frame of EC lays emphasis on restriction of origination of wastes and on exploitation of generated wastes and their elimination only by methods which are not harmful to people health and the environment [6]. Secondary sources should gradually replace primary ones where it is technically possible and economically effective and in this way it will contribute to reduction of material and energy demandingness of production. Higher payments are to motivate companies to limit waste disposals which will be much more expensive during next years. The environmental aspect is an element of organization activities or products that can interact with the environment [7]. Scheme of product lifecycle illustrates **Fig. 1.**

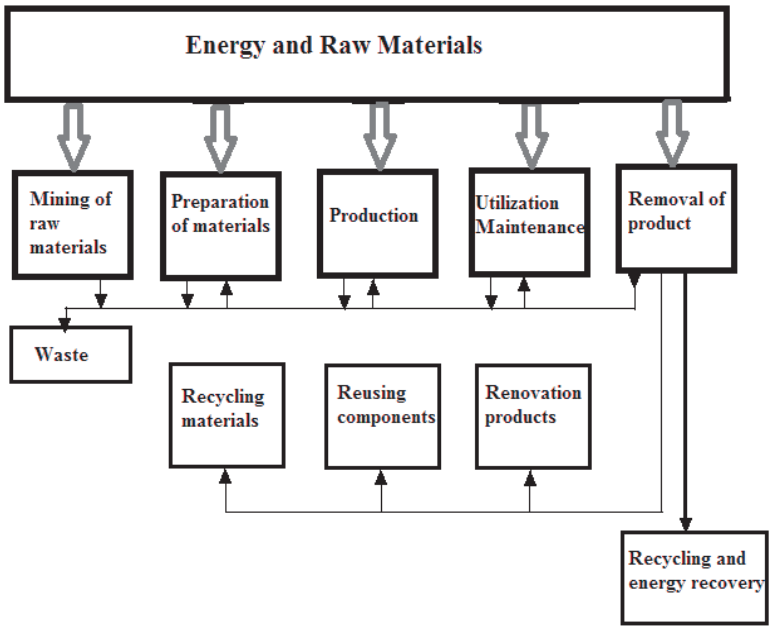

Fig. 1 The scheme of product lifecycle

3. ALTERNATIVE STRATEGIES FOR COST REDUCTION

From the point of view of economy increase of metallurgical companies and cost reduction it would be suitable to apply also some alternative (untraditional) procedures:

- application of untraditional alternative fuels,
- use of pre-deoxidized charge for blast furnaces,
- present addition of two charge components.

The use of some alternative procedures illustrates **Fig. 2.**

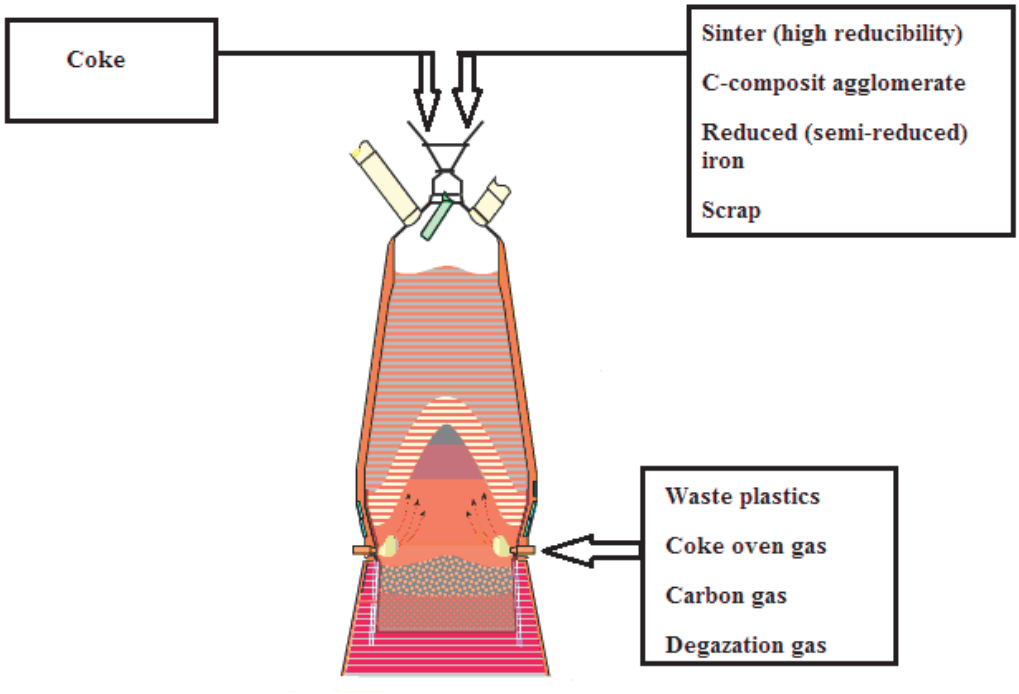

Fig. 2 The use of some alternative procedures

There are several properties characterizing the quality of metallurgical material [8]. One of the most important and specific for production process are metallurgical properties of used feedstock [9]. At VSB - Technical University of Ostrava, Centre ENET the reducibility of metallurgical material supplied from ironworks was tested. This device is also possible to use for sinter and lump ore testing [10].

The need of connection of technical and economic data for complex evaluation of a blast-furnace process seems to be a very advisable. Besides accompanying elements which are advisable for iron pig production, also elements and metals get into blast furnace together with metallic charge which are not wanted for the process, such as alkali metals and zinc.

Alkali cyanides are generated in blast furnace in the zone of tuyeres by reactions of alkali metals with coke carbon and air nitrogen. Furnace gas puts them into stack where they condensate on colder furnace filling. Alkali cyanides settled down on the charge descend to the zone of higher temperatures where they react with carbon dioxide. Generated alkali carbonates react further on with nitrogen contained in gas during generation of other cyanides. Through furnace gas they are again transferred to the stack where they again condensate, they fall together with the charge into lower furnace parts with a high temperature. Between stack middle parts and tuyeres´ zone the circulation of alkali cyanides is created to which newly generated compounds come up so that concentration of these substances increases [11].

Alkali presence in the furnace is technologically not wanted because alkali metals and their compounds circulating in the furnace influence unfavourably coke quality. Mechanical strength and wear resistance is reduced by their activity; it means that coke degradation increases when passing through the furnace [12].

4. CONCLUSION

Economy of pig iron production is determinative for competition ability of connected steel and rolling mill production. It is connected both with cyclic changes in steel business and changes caused on the market with

iron ores and fuels. Repeated variations of inputs as well as outputs influence more and more the economy and competition ability of metallurgical companies. The first tests of metallurgical waste-briquettes and pellets reducibility from metallurgical dust were carried out at VSB-TUO. Reducibility in test samples was comparable to the value commercially used sinter.

The achieved test results confirmed that the application of these unconventional alternative fuels (waste) into the blast furnace is beneficial both from an environmental and economic perspective. However, further research focused mainly on the quality of the metallurgical waste is necessary.

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