A R C H I V E S O F M E T A L L U R G Y A N D M A T E R I A L S
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COMPUTER – AIDED CHARGE MANAGEMENT SYSTEM FOR ELECTRIC STEELWORKS

SYSTEM ZARZĄDZANIA ZAŁADUNKIEM WSPOMAGANY KOMPUTEROWO DLA STALOWNI ELEKTRYCZNYCH

The paper presents Computer System to Support Charge Management in Electric Steelworks. Programs entering in the composition of the system count in the optimum way added materials to the electric furnace and to ladle furnace. The program of the calculation of added materials under planned production was also introduced. Programs were worked out as the module, network, multi-access servers of the application. The part of programs was implemented to the industrial practice in electric steelworks and foundries.
Keywords: Computer-aided, charge, management, system, electrosteelmaking

W artykule przedstawiono komputerowy system wspomagania zarządzaniem załadunkiem w stalowniach elektrycznych. Programy wchodzące w skład systemu wyliczają optymalną drogę materiałów wsadowych do pieca elektrycznego i pieco-kadzi. Przedstawiony został program do obliczeń materiałów wsadowych według zaplanowanej produkcji. Programy zostały zrealizowane jako moduły, sieć oraz serwery wielodostępne aplikacji. Część programów została wprowadzona do praktyki przemysłowej w stalowniach elektrycznych i odlewniach.

1. Introduction

Electric Arc Furnace steelmaking and secondary metallurgy processes are in modern ferrous metallurgy characterized by a big complexity. The course of these processes and final steel product properties depend on many, often hardly to specify, factors and therefore it is important adequate operative heat management and optimization metallurgical parameters influencing quality and manufacturing costs.

2. Computer – aided production technology system

Process engineering and operative management are computer-aided. To this end were developed a number of computer programs. These programs were worked out as the module, network, multi-access servers of the application.

Computer – aided process engineering is based on following programs:

– optimum charge material selection program (OCMSP) for electro steelmaking process and,
– optimum alloy addition selection program (OAASP) for secondary metallurgy in ladle furnace process.

The OCMSP program composes optimum charge for electric are furnace steel melting process with regard to various optimization criteria especially minimum charge cost criterion and minimum heat cost criterion. Computations are accomplished for standardized content particular element in steel grade and for accepted constraints on quantity and type of material in the charge.

The OAASP program computes additions during ladle furnace metallurgy process for the minimum cost criterion.

Methodology to practical application computer-aided systems for EAF and LHF was developed [1, 2], which includes following (Fig. 1):

- Description and algorithmization process engineering in form of basic mathematical models.
- Data base arrangement, object identification testing, basic models verification.
- Definition goals of control in the form of optimalization criteria.

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- Generation from basic models, models for optimalization purposes.
- Software development.
- Carrying out computer simulations.
- Tests to practical application of programmes till getting of the results acceptable in respect of production technology.

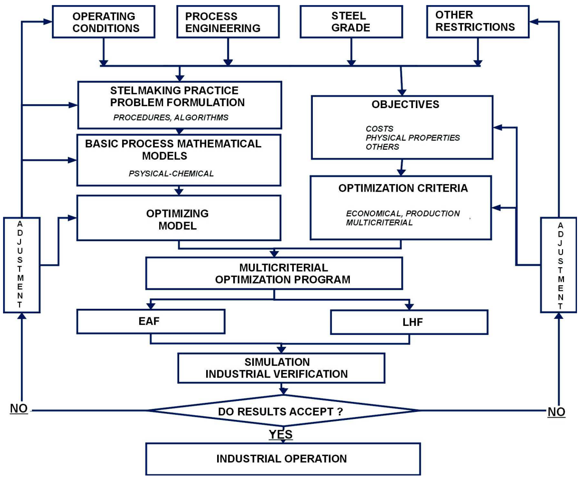

Fig. 1. The methodology of the Implementation Computer System to Support Charge Management in Electric Steelworks

3. Computer-aiding for operative management

In the scope of operative management has been developed the Program of charge materials blending and ordering under the planned production (PCMB) in any temporal horizon [3] (Fig. 2).

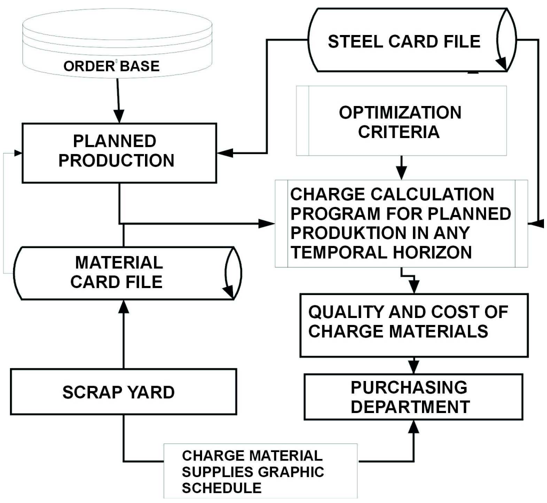

Fig. 2. Computer System to Support Charge Management in Electric Steelworks

This Program computes for every steel grade the charge material forecast demand necessary to one metric ton steel production, with regard to charge material accessibility.

From the order file, short – and long – term productive schedules are generated, including informations on the date, quality and grade of planned production. The informations on productive schedules and charge material reserves at disposal make input data to the system. After the computations, the reports are generated on quantity and cost of charge materials indispensables to the planned production.

Results of computations make instructions, for steelwork's supply services, determining tight charge material purchase schedule for planned production. Use the PCMB minimizes overstocks and facilitates a production continuity support.

4. Industrial implementation

OCMSP System was practical applied to ISP Częstochowa Steelworks for charge blending to 90 ton EAF [1]. On Fig. 3 main objectives of optimum blending basket charge program are shown and Fig. 4 presents the example of report printout on optimum charge blending for EAF.

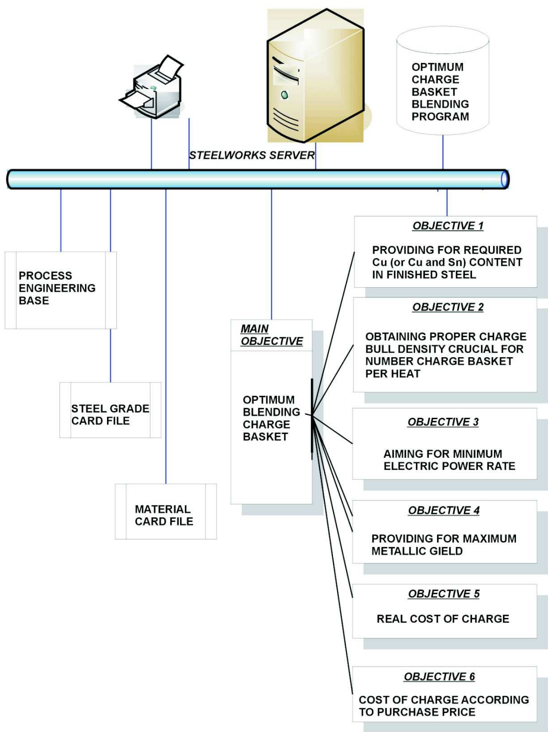

Fig. 3. Objective optimum blending basket charge program

OCMSP and OAASP systems were implemented to roll foundry in Huta Buczek, Sosnowiec for charge materials and media management in electric induction furnace plant [4].

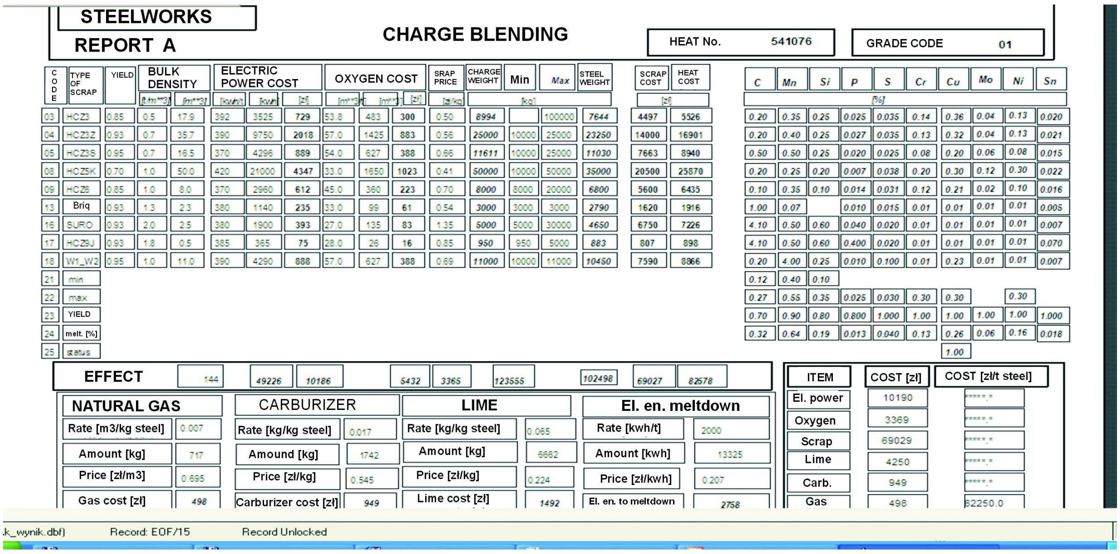

Fig. 4. Report printout on optimum charge blending for EAF

5. Summary

The operation these systems confirmed flexibility of the Programs for changing process and production conditions.

High economic effects were gained, resulting first of all, in cost heat reduction and tap-to-tap time repeatability in virtue of accuracy improvement on aimed Cu content in liquid metal at meltdown, optimum number charge basket per heat, charge bulk density increasing etc.

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