ASSESSMENT OF STEELMAKING PROCESS QUALITY BASED ON A SELECTED ENTERPRISE EXAMPLE

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Abstract
Ensuring the high quality of products and semi-finished products is a primary goal of most enterprises. The paper presents an analysis of steelmaking process quality. This analysis was carried out based on selected quality assessment measures. Numbers of complaints, of production rejects and of off-heats were considered. The analysis showed that the majority of quality problems the company had in 2010. preventive actions and corrective decreased level of quality problems to about 1% in 2012. Test the company has appointed a quality objectives for 2013. The quality targets imply lower levels of complaints and of off-heats were considered. Level defective production in recent years has significantly narrowed, and is at an acceptable level.

Keywords: quality steelmaking process, once valuation of steelmaking

1 Introduction
Ensuring a high quality of manufactured products and semi-finished products is the main target of the most enterprises [1, 2]. The quality of products offered on the market to a great extent decides about manufacturer’s market position and success [7, 14, 17]. So this is the basic requirement to obtain a high level of company competitiveness on the market [4]. An economic aspect of management by quality is also important, referring primarily to the quality costs [2]. A systematic control, recording, identification and analysis in the field of quality is the basis to determine any deviations and incompatibilities and to undertake corrective measures [3]. An important part of ensuring an adequate level of quality is also corrective and preventive action [12, 13]. These actions are used to determine the quality objectives for the following years of the company [15].
The paper presents considerations related to quality issues in the manufacturing activity of one of Polish steelworks. The investigations concerned the steelmaking shop of Ferrostal Łabędy Sp. z o.o.

2 Quality management system in the investigated enterprise
The quality management system in the analysed enterprise is an element of implemented and continuously improved quality management system consistent with requirements of ISO 900:2009 standard [16, 17]. Quality plans are controlled quarterly, while once a year management review reports are prepared, which are developed based on an algorithm of quality
tests provided in the Quality Book of Ferrostal Łabędy Sp. z o.o. Monitoring and measurements methods and criteria are defined in quality plans, laboratory procedures and technological instructions [5]. In accordance with the Quality Book the following instruction are prepared for the annual report:

- report on documentation kept, on supervision,
- report on internal audit,
- report on undertaken corrective and preventive actions.

This part of the report is prepared by the management plenipotentiary for the quality management system. The report contains also elements of individual departments assessment. The second part of the report consist of:

- report on customer service quality,
- report on tests supervision and control,
- report on the steelmaking process quality,
- environmental impact report.

Studying the steelmaking process quality it is necessary to specify, that this process quality is proven by the number of complaints, the number of production rejects and the number of off-heats (Fig. 1). The studied enterprise manufactures also products to customer orders. The steel production to a special order is carried out in a separate heat. If – after such a heat – the chemical composition is not consistent with the customer order then such heat is referred to as off-heat (Fig. 1 shows data from a qualitative report by the enterprise).

In the studied period the number of complaints made by customers has been decreasing, which proves that heats are run with a high accuracy and in accordance with the customer order. The number of off-heats went down to 1.5% and of production rejects to 1.02%, which proves a high quality of the steelmaking process.

The steelmaking process in the investigated enterprise is highly computerised and IT controlled. Records related to the course and results of manufacture and to products monitoring and measurements are stored in the IT system [4]. The IT system for the steelmaking process was developed and implemented exclusively for Ferrostal Łabędy Sp. z o.o. by a specialised company involved in implementation of IT systems in large production companies.

3 Identification of the steelmaking process quality level

Production quality assessment measures reflect the production quality in the studied enterprise [6]. Among numerous steel grades produced by the studied enterprise the highest indicators of accepted complaints registered by the enterprise are shown in Fig. 2.
Despite a small share in the production, steel 31Mn4 has the highest complaints indicator. The other steel grades feature a relatively low complaints indicator as compared to the production size. In the studied enterprise the complaint numbers in excess of 20% are considered threatening the products quality. Only one of products has exceeded this index. However, the size of this index excess is that large that the owners made a decision on a temporary suspension of this steel type. Unfortunately, the reasons for this phenomenon are not known. The production was stopped till the moment of determining reasons for such a large number of inconsistencies with the order.

The most frequent reasons of complaints comprised stress cracks (82%) and sub-surface inclusions (18%). The level of complaints for billets production in the years 2006 – 2012 is presented in Fig. 3.

Ferrostal Łąbędy Sp. z o.o. has been studying also numbers of internal rejects. Such products could be named internal rejects (internal rejects – the internal name used in the enterprise), which do not comply with standards due to damages or defects during production. Internal rejects may include also sculls and billets, which do not meet quality requirements. Numbers of rejects in the years 2006 – 2012 are presented in Fig. 4.
The number of rejects is around 6-7% of the production. Sculls are a relatively small percentage of rejects, the other part of rejects consists of billets. An increasing number of rejects recorded in recent years is related to a high personnel turnover.

Another element, affecting the quality of steelmaking process, is an off-heat related to heats made to customers order. In the studied enterprise an off-heat was defined as a heat, in which individual additions contents deviate by 0.1%. The number of off-heats in the production process of Ferrostal Łabędy Sp. z o. o. is presented in Fig. 5.

Off-heats acceptable to the enterprise are around 1%. Numbers of off-heats have been exceeding the acceptable level since 2010. A significant increase in improper heats occurred in the years 2011 and 2012. However, this is not related to the deterioration of the steelmaking process quality.

4 Assessment of the production process quality by the studied enterprise
Based on reports and management review reports prepared by the company decisions are made regarding further activities in the enterprise [8, 9]. The company – after carrying out an internal control – undertakes preventive and control measures. Preventive measures may include actions eliminating reasons for inconsistencies in the company. Corrective measures should be adapted to effects of the found inconsistencies to prevent their reoccurrence, are the only ones measures
taken to prevent. The effectiveness of carried out actions is calculated based on proportions of the set and achieved quality targets in the company. Fig. 6 presents the effectiveness of actions undertaken in the enterprise.

Fig. 6 Effectiveness of corrective and preventive actions

The studied enterprise undertakes various actions to improve the steelmaking process quality. The activities carried out are highly effective. Activities resulting from the annual management report and determined as a result of an off-heat examination have best effects to improve the equality. The 2012 annual report obliges employees to undertake actions to improve the quality:

- frequent updating of steelmaking assessment indicators,
- updating procedures for off-heats,
- improving the products quality via a frequent analysis of defects origination reasons,
- establishment of a complaint service procedure.

The report specifies also quality targets, which should be sought by the company. In 2013 the studied enterprise strives for reducing the level of quality problems (Fig. 7).

Fig. 7 Quality Objectives for 2013
The determined quality targets assume reduction of the level of complaints and of off-heats. In recent years the level of production rejects has substantially diminished and is on an acceptable level. Levels of the other indicators will be lowered due to accomplishing individual quality targets determined by the company management.

5 Conclusions

The quality of products and services is an important element of enterprise competitiveness, most often deciding about the company success [10, 11]. A competitive advantage may be reinforced and costs may be long-term cut through an actual improvement to the manufacturing process quality. The steelmaking process in the studied enterprise is stable. Corrective actions taken subject to confidentiality in company. Actions undertaken by the company to ensure a quality production are well thought-out and are aimed at reduction of costs related to complaints and at continuous improvement to the offered products quality. At the same time it should be emphasised that a continuous improvement to the product and process to a large extent is a quality management objective.

References