Characteristic of Weighing Process of Lump Charge Materials Using Electromagnet

K. Schmalenberg, E. Ziółkowski *
AGH University of Science and Technology, Faculty of Foundry Engineering,
Reymonta 23, 30-059 Kraków, Poland
* Corresponding author. E-mail address: ez@agh.edu.pl

Received 14.01.2018; accepted in revised form 08.05.2018

Abstract

In cast iron foundries, used ferromagnetic batch materials can be transported and loaded into the furnace by lifting magnet. The precision of these operations by using electromagnetic grippers depends primarily on the variation in the mass of the batch material pieces. The article presents the characteristics of size of the batch materials used in the selected iron foundry. The obtained ranges mass values of individual pig iron ingots have been presented. It has been found that the mass of individual pig iron ingot may differ ± 25% from the declared by producer. The mass range of individual pieces of crushed or uncrushed return scrap was examined. Some pieces of uncrushed scrap have the mass more than three times the average weight of pieces of this scrap. Characteristics of the lifting capacity of these materials by a lifting magnet suspended to the crane was determined. Analysis of the obtained results indicates that for materials with less diversified mass of individual ferromagnetic pieces it is possible to use a gripper to weight a bigger portion with the same control setting. It was also found that there is a significant dispersion for a given gripper control, especially for materials with a wide range of individual pieces mass changes.

Keywords: Weighing process, Charge materials, Electromagnet using

1. Introduction

In many foundries producing cast iron castings, lifting magnet are used to assemble the charge material for foundry furnaces [1-4]. These grippers are suspended to the gantry, additionally equipped with the electronic weighing scales. Ferromagnetic charge materials, such as various types of steel and iron scrap, pig iron or ferroalloys, are in the form of a charge with a diversified mass range of individual pieces [5, 6]. The article will present the influence of the different types of weighted bath materials on dispersion of weighted mass, for the adopted settings of the gripper's feeding system.

2. Abbreviated characteristics of weighted batch materials

In the selected cast iron foundry, two types of pig iron are used: processing and special [5, 6]. Both grades are delivered to the foundry in ingot. The pig iron (Fig. 1) has a chemical composition according to the certificate provided by the manufacturer: 4.11% C, 0.64% Si, 0.064% Mn, 0.052% P and 0.015% S. The weight of a single piece of ingot in the certificate is 12 kg. The special casting iron (Fig. 2) has the following chemical composition: 4.20% C, 0.17% Si, 0.007% Mn, 0.012% P and 0.008% S. The weight of one ingot of this pig iron, as per the certificate, is 12 kg.
In order to check the mass stability of individual pieces of ingot, several dozens of ingots have been weighed. Fig. 3 shows the results of weighing individual ingots special pig iron.

The analysis of the graph on Fig. 3 shows that the mass of weighed individual ingots in the range from 8.7 kg to 15.4 kg, i.e. it exceeds ± 25% of the middle weight of one piece of 12 kg according to the manufacturer of the ingots special pig iron. Fig. 4 shows a return scrap lump which is not previously crushed for remelting.

The graph analysis shows that some pieces of not crushed scrap have the mass more than three times the average weight of pieces of this scrap.

The crushed scrap used in the iron foundry (Fig. 6) has a smaller mass distribution of the individual pieces compared to the not crushed scrap as shown on Fig. 7.

The different mass and size of individual pieces of ferromagnetic materials affect the precision of weighing using a lifting magnet.

The mass of individual pieces of this scrap is very diverse, as shown on Fig. 5.

3. Characteristics of weighing using a lifting magnet

In the process of weighing and transporting in the foundry of such ferromagnetic materials as special or processing pig iron,
crushed and uncrushed return scrap lifting magnet is used as shown on Fig. 8.

The analysis of this graph shows that using a lifting magnet, for the same setting of the lift regulator, weigh a much larger mass of ingot pig iron than returning scrap. Returning crushed scrap can be weighed about twice as much at the same regulator setting than uncrushed scrap.
4. Conclusions

The carried out research tests mass of the ferromagnetic materials weighed using a lifting magnet allow us to develop appropriate weighing characteristics. The mass scatter of results values obtained for individual ferromagnetic materials, for the same settings of the regulator the strength of the lifting magnet, allows to estimate the precision of obtaining the assumed shares in the furnace feed. The developed weighing characteristics can be the basis for designing algorithms for controlling the batch assembly process together with the appropriate correction of weighing errors resulting from the use of a lifting magnet in the foundry [9].

References