National University of Science and Technology

Think in Other Terms

FACULTY OF INDUSTRIAL TECHNOLOGY

DEPARTMENT OF CHEMICAL ENGINEERING

RESEARCH & DEVELOPMENT PROJECT 2012

Project Title: Induction Furnace Predictive Model Controller

STUDENT NAME:	SELWYN M. MUNATSI
REG. NUMBER:	N007 0325C
SUPERVISOR:	Miss. S. BHEBHE
CASE STUDY:	STEELMAKERS ZIMBABWE

<u>**Year 2012**</u>

Submitted in partial fulfilment of the Bachelor of Engineering Honours in Chemical

Abstract

The Induction furnace steelmaking process at Steelmakers Zimbabwe is currently suffering from high production cost coupled with high rejection rate of the products which are out of the required elemental composition. Preliminary investigations shows that the fluctuations of the scrap metal prices, pricing utility costs and uncontrolled furnace raw material charging system are amongst the major contributors to this problem.

Based on the chemistry of steelmaking the effect of DRI on the hot metal bath was investigated. The laboratory experiments carried out revealed that DRI melting rate depends on the percentage charged and the effects of DRI on the elemental composition of the hot metal bath can have empirical regression equations which can be used to determine the composition of the DRI scrap equivalence.

A single furnace linear programming model was developed basing on the mass balance constraints of the furnace. The model formed the basis for the development of the Induction Furnace Predictive Model Controller.

Recommendations were made to use the Induction Furnace Predictive Model Controller as a decision making tool for the continuous management study in the steelmaking industry. Also the Induction Furnace Predictive Model Controller should be integrated into the Steelmakers Zimbabwe smelting process so that they meet the target steel grade at minimum raw material costs, which ultimately improves the economic viability of the process.

Keywords: Direct Reduced Iron (DRI)   Predictive Model Controller (PMC)   Scrap metal Induction Furnace