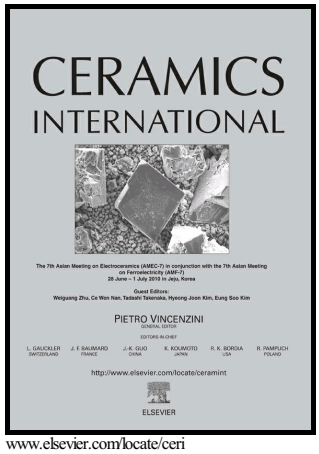
Thermodynamic assessment and experimental validation of clinker formation from blast furnace slag through lime addition

Kali Prasad, C Srishilan, Ajay Kumar Shukla, Marutiram Kaza



www.elsevier.com/locate/ceri

PII: S0272-8842(18)31921-7
DOI: https://doi.org/10.1016/j.ceramint.2018.07.180
Reference: CERI18902

To appear in: *Ceramics International*

Received date: 13 June 2018
Revised date: 18 July 2018
Accepted date: 20 July 2018

Cite this article as: Kali Prasad, C Srishilan, Ajay Kumar Shukla and Marutiram Kaza, Thermodynamic assessment and experimental validation of clinker formation from blast furnace slag through lime addition, *Ceramics International,* https://doi.org/10.1016/j.ceramint.2018.07.180

Thermodynamic assessment and experimental validation of clinker formation from blast furnace slag through lime addition

Kali Prasad[a]*, Srishilan C[a], Ajay Kumar Shukla[a], and Marutiram Kaza[b]

[a]Department of Metallurgical and Materials Engineering, Indian Institute of Technology Madras, Chennai-600036, India
[b]JSW Steel Plant R&D Centre, Toranagallu, India

*Corresponding author: Tel.: +91 44 2257 4762. Email address: kali.iitm@gmail.com

Abstract

In the present study thermodynamic simulation of chemistry modification of blast furnace slag by lime addition to obtain clinker composition has been carried out. The effects of lime addition on each mineralogical phase under the equilibrium are simulated using FactSage 6.4 thermodynamic software. The critical value of lime addition in slag for each mineralogical phases and its effect on liquidus temperature of the slag has been reported. The desired cementitious phase namely belite has been observed beyond 14.4 % of lime addition. A decreasing trend is observed in the liquidus temperature of the mixture from 1530 ºC to 1497 ºC for the lime addition of 15 % to 24%. The simulation results were further validated by experiments conducted on blast furnace slag in the laboratory. Energy-Dispersive X-ray Spectroscopy analysis were used to qualitatively estimate the mineralogical phases formed after melting of the slag mixtures in the laboratory followed by air cooling.

Keywords: Cement clinker, Blast furnace slag, FactSage, Characterization

1. Introduction

The consumption of iron and steel is increasing with growing industrialization, and the raw materials of lean quality and the alternative ironmaking routes further lead to increase in the slag volume. Effective disposal of slag is a major environmental concern for the steel plants. Nowadays major emphasis is given towards processing of slag to a valuable product. Nearly 320 kg of slag per ton of hot metal is produced, from the blast furnace. The blast furnace slag (BFS) tapped at 1450 - 1550 °C is mainly composed of CaO, Al_2O_3, SiO_2, and MgO, which is similar to the major constituents observed in Portland cement [1]. The close resemblance of the chemistry