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Effect of Inlet Oxygen Concentration on the Thermal Behavior of Magnetite Pellet Oxidation

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Abstract

Magnetite had a great share in feedstock supplement for steel industry through the last 50 years and will continue to have from now on. The oxidation of Fe_3O_4, being highly exothermic, provides a notable part of the total energy required for induration. There have been a number of experimental and numerical studies to investigate the thermal behavior of magnetite green pellets during the oxidation; however, these works had major deficiencies from the viewpoints of information they provide and also the assumptions they made for mathematical models. In order to compensate for these shortcomings, one-dimensional model framework for a single pellet proposed through the solving transient differential conservation equations for mass, momentum and energy. Predicted results validated against the experimental data from the literature and close agreement was achieved. Results showed that, using pure oxygen, magnetite pellet could achieve a temperature rise of 120 K. Moreover, maximum temperature gradient inside the pellet is approximately 40 K.

Keywords*:* nonanalytic gas-solid reactions, magnetite oxidation, modeling

1. Introduction

The duration and temperature of the oxidation cycle play a key role during the iron ore pellet induration. High oxidation temperature (>1350 °C), leads Fe2O3 to decomposes in to Fe3O4 which consequently deteriorates the pellet quality including severe loss in compressive cold

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