POTENTIAL OF MANGANESE ORE FROM MADAKA FOR FERROMANGANESE PRODUCTION

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Abstract

This research work involves characterization of manganese ore from Madaka in Rafi local Government of Niger state by sintering at 1100^{0}C for use in the production of ferromanganese alloys in electric arc furnace. The raw and sintered ores were characterized by Electron Dispersed X-Ray Fluorescence (EDXRF), X-Ray Diffraction (XRD) and Scanning Electron Microscope (SEM). The observable mineralogical phases/compositions in the ores were Quartz and Braunite. The reaction of the different ores (lime, coal and manganese) was carried out through sintering using electric furnace 1100˚C and mixture of CaO, CO and CO_2 gases generated from the blend. The sintering process was carried out for one hour and the sintered ore was also characterized. The results showed that Braunite in the ore was converted to Spessartine and Manganosite (MnO) at 1100˚C. However, the manganese ore content was converted to MnO and $Mn_3Al_2(SiO_4)_3$. Consequently, it is clear that the Mn ore separation is achievable at higher sintering holding time and smelting temperature than 1100□, which is the essence of this research. An assumption is that the reduction with coal and fluxing agent (lime) to $Mn_3Al_2SiO_4$ and MnO has occurred and will require more holding time or higher melting temperature to transform fully to MnO suitable for ferromanganese production.

1. INTRODUCTION

Industrialization in Nigeria and Africa continent will be a mirage, without value addition to indigenous ore minerals. There should be a renewed focus on exploration and exploitation of the abundant mineral resources and encouragement of the development of local contents. Ajaokuta Steel Complex had its Rolling Mills commissioned in 1983. The plant on completion is expected to produce 1.3 million tons of liquid steel to feed the various in-land rolling mills. In spite of these lofty dreams and huge potentials, the plant is still a shadow of itself. For smooth take-off, necessary consumables like refractories and ferroalloys must be readily available in the country via local development and production.

Ferroalloys are alloys of one or more other elements with iron. They form essential input for iron and steel industries and are employed to add unique properties to steel (Gasik, 2009). The major ferroalloys are those of manganese, chromium, silicon, molybdenum and titanium added to improve the properties of steel and alloys. They are introduced in specific quantities in the most practicable and economic manner (Gasik, 2009; Holappa*et al.* 2013). In fact, no single steel grade is produced without the addition of ferroalloys (Wood and Owen 2005). Ferroalloy production is an integral part of manufacturing chain between the mining and steel making (Gasik, 2009).

The demand for ferromanganese at the moment is continuously increasing especially in steel industry (Holappa *et al.* 2013). This is as a result of increment in the consumption of steel products in automobile and manufacturing industries. Ferromanganese consists of various grades including high carbon (HC), medium carbon (MC), and low-carbon (LC) grades. High-carbon FeMn is the traditional form of ferromanganese, with 70-80% Mn and 6-7% C and is the largest tonnage of ferroalloy used. It is a deoxidizing agent in steelmaking and an important alloying element. It has the property of controlling the deleterious effect of sulphur in steel (Eric, 2014). Medium and low carbon