Process Mineralogical Studies of Charagah Manganese ore

M. R. Hojjati-rad
M. Sc Student., Department of Mining and Metallurgical Eng., Amirkabir University of Technology, Tehran, Iran.

M. Irannajad*
Associate prof., Department of Mining and Metallurgical Eng., Amirkabir University of Technology, 424, Hafez Ave.Tehran, 15914, Iran. Phone: +982166419729, Fax: +982166405846, iranajad@aut.ac.ir

A. Mehdilo
PhD Student in Mineral Processing, Department of Mining and Metallurgical Eng., Amirkabir University of Technology, 424, Hafez Ave.Tehran, 15914, Iran. amehdilo@yahoo.com

ABSTRACT

Charagah ore deposit is located in the 82 Km at the North-West of Tabriz, Iran. Mineralogical studies performed by XRD, XRF, Optical microscopy and SEM equipped by WDX indicated that the ore is contained 17% Pyrolusite, 78% calcite and 3% quartz approximately. Pyrolusite as a main valuable mineral is found in the forms of coarses and fines pyrolusite. The coarse grains pyrolusite with simple texture is liberated in 180 microns. This liberation degree was determined by image analysis software. Another kind of pyrolusite has very complicated texture and interlocking with gangue minerals. This interlocking is even found finer than 10 microns sizes. So, concentration of coarse part of the ore will be possible easily by gravity methods such as tabling and heavy media separation. The flotation process is predicted for separation of fine grains pyrolusite, however the hydrometallurgical method can be used for upgrading of the finest fractions or slimes which are usually contained significant amount of pyrolusite.

Keywords: Pyrolusite, Manganese Ore. Process Mineralogy, Image Analysis, Gravity Separation

INTRODUCTION

Manganese is used mainly in steel production, directly in pig iron manufacture and indirectly through upgrading ore to ferroalloys. Globally, most (90 to 95%) Mn is used in the metallurgical industry as a requisite deoxidizer and desulfurizer in steel making and as an important alloy component. Various amounts of Mn commonly are added to the steel for industrial use, making low or high Mn alloys. High grade ores (Mn content more than 42%) are usually used in metallurgical application. The remainder of the Mn (5 to 10%) is used in the chemical industry, light industry, production of dry cell batteries, in plant fertilizers and animal feed, and as a brick colorant. The main manganese minerals are the oxide types, such as pyrolusite, MnO_2; hausmannite, Mn_3O_4; and manganite, MnO(OH) (Delian Fan, Peiji Yang, 1999) . Manganese is also found in several minerals, such as pink rhodochrosite ($MnCO_3$), rhodonite ($MnSiO_3$), black manganite (MnO(OH)), and alabandite (MnS). Minerals such as rhodochrosite, rhodonite and hausmannite are often replaced by pyrolusite. Pyrolusite containing 63.2% Mn is the most common manganese mineral) (Wensheng Zhang, Chu Yong Cheng, 2007). Manganese ores may accumulate in metamorphic rocks or as sedimentary deposits, frequently forming nodules on the sea floor (L. A. Corathers and J. F. Machamer, 2006).

The main sources of manganese come from the former U.S.S.R, Brazil, South Africa, Australia, Gabon and India. Russia and South Africa produce about 85% of the world's pyrolusite. Manganese nodules or ferro-manganese concretions, usually containing 30–36% Mn, have been found on ocean floors (Calvert, 2004) and could provide another source of manganese. These nodules are found in both the Atlantic and Pacific Oceans, but principally in the Pacific Ocean. Although the primary interests in deep sea nodules are nickel, copper, and cobalt values, the large quantities of manganese could also be of future importance. As a result, much research work has been devoted to recovering not only nickel, copper and cobalt but also manganese as well (Wensheng Zhang, Chu Yong Cheng, 2007).

Industrial manganese ores vary significantly in chemistry and mineralogy. It is well-known that the properties of a manganese ore have a large influence on the technology and efficiency of the production of manganese alloys. The melting and reduction behavior of ores are defined by their chemistry, mineralogy and physical properties, which change as the ore is heated in a reducing atmosphere in a ferroalloy furnace. Mineralogy and geology of manganese ores have been