MAGNETIC ROASTING OF SOME EGYPTIAN FERRUGINOUS MANGANESE ORES(*)

S.Y. Ezz, Dr.A.A.Yousef,
Dr.T.R.Boulos & A.A.El Geassy,
National Research Centre,
Cairo, U.A.R.

For the production of ferromanganese, the Mn/Fe ratio should be 8:1 or more. In fact, it is this ratio that establishes the metallurgical high grade of the ore. This study was made on samples from the vast reserves of low-grade ferruginous manganese ores which are usually neglected because of their high iron content. The iron minerals found in these ores being mainly hematite and other hydrated iron oxides, it was proposed to investigate their separation by a magnetizing roasting method. In this case, in addition to the ferromanganese, another pig iron concentrate is also produced.

Three representative samples, having the colloform texture of psilomelane, were collected from Sinai district. Photomicrographs of these samples reveal the presence of pyrolusite and manganite minerals as well as different gangue minerals. The manganese content ranges from 10 to 20% and the iron from 40 to 50%.

The fluo-solid technique of reduction was used since the transformation of the non-magnetic iron oxides to the magnetic form takes place readily in the fluidized layer. The reduction apparatus consists mainly of a silica tube, 3.5 cm. inner diameter and 70 cm. long, with a sintered silica disc fixed 40 cm. from its bottom. Necessary arrangements for gas purification, pressure measurements and thermo-couples were provided in the reduction system. The maximum fluidizing gas velocity was determined by Leva's formula.

The rate of reduction was found to increase when temperature was raised, as this depends on gas-solid diffusion, on the dynamic potential of the reaction-which is related to the fundamental driving energy- and on the free energy of the reaction and both the diffusion and the free energy increase with temperature.

(*) Paper for presentation at the Symposium on "Recent Developments in Non-Ferrous Metals' Technology" - 4th to 7th December, 1968, Jamshedpur.

The Davis-tube results determine the time for complete transformation to magnetite. This is visualized by an optimum weight percent of the magnetic product and an optimum iron content. X-ray analysis also confirms this conclusion. The wüstite stage could also be identified by the corresponding decrease in the weight percent of the magnetic product, when raising the temperature above 400°C. On the other hand, when decreasing the reduction temperature below 400°C, longer time is required to obtain the same results as at 400°C.

The rate of reduction was also controlled by the rate of flow of the reducing gas. This is due to the intimate contact between the gas and the ore which permits the formation of gaseous products.

The effect of particle size of the feed on reduction was also studied. The normal initial increase in the reduction rate, with decrease in particle size is followed by a drop in reduction rate which may be attributed to channeling effects. However, the application of a synthetic mixture of different sizes similar to the screen analysis of the ground ore, was found to be suitable as a feed for the fluidized bed.

/Ahmed