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SULPHATISATION AND SULPHIDISATION FOR HYDROMETALLURGICAL EXTRACTION OF MAIN CONSTITUENTS OF A LOCAL ILMENITE ORE(*)

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Ilmenite ores occur in UAR in big quantities, constituting two main reserves, at Abu Ghalaga (AG) in the South-Eastern Desert, and on the shores of the Nile Delta in Rosetta and El-Arish. AG ilmenite occurs in the form of lenticular, vein-like bodies intimately associated with metagabbro. The Chief lens is about 300 m long, 150 m wide, and 45 to 100 m thick. Several investigators have studied the leachabilities of titanium bearing materials after being sulphatised or sulphidised. A common practice frequently utilised with ilmenite ores involves sulphatisation with H_2SO_4 through batch or continuous digestion. The factors influencing the breaking down of the ore, including acid concentration, temperature, particle size and catalysts, have been investigated. Other sulphatising agents were also used, particularly ammonium and sodium sulphates.

Sulphidisation of ilmenite ores is not as yet well studied. Several investigations were carried out, however, on the preparation and properties of titanium sulphide by sulphidising TiO_2.

In the present work Fe_2O_3-TiO_2 mixtures, as well as AG ilmenite, are sulphatised with ammonium sulphate or sodium bisulphate under a variety of conditions, followed by leaching with 7N H_2SO_4, Sulphidisation is also performed using ZnS, followed by leaching with 1-1 HCl. The products obtained are subjected to chemical and X-ray analysis, and separation techniques of iron and titanium are tried.

Meterials and Experimental Technique

A 10 Kg. sample of AG ilmenite was crushed to a size of about 10 mm and a representative sample was taken by quartering. Chemical analysis of the chief constituents yielded 39.2% for total iron, 18.9% Fe^{2}, 41.15% for titanium, and 3.1% for silica. This corresponds to 27% TiO_2 combined with FeO in the form of $FeTiO_3$ and the reminder is either combined with Fe_2O_3 as pseudobrookite

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or forms a solid solution with ilmenite. Spectroscopic investigation revealed the presence of Al,Ca,Mn,V, Co,Ni,Cd,Mg, and Zr as trace elements.

X-ray diffraction gave lines of maximum intensity corresponding to ilmenite, with less intense lines of hematite; no lines for pseudobrookite were detected. Mineralogical investigation showed that the mineral is chiefly composed of a granular mosaic of ilmenite grains (70-75% of the ore) in the form of anhedral to subhedral crystals of diameter ranging from 0,8 to 0.2 mm. The interlocking grains are sometimes separated by quartz or silicate gangue, and they often enclose exsolution bodies of hematite. Electron-probe micro-analysis revealed the presence of a main titaniferous structure composed of both titanium and iron oxides in varying composition. The grains contain pure iron oxide, silica, or iron sulphide as inclusions. The mixture of the sample with the sulphatising agent was placed in a covered crucible and heated in a previously calibrated automatically-controlled electric muffle furnace.

Sulphidisation with ZnS was performed in a tube furnace provided with rolls which move smoothly on rails. The reaction tube was closed from both ends and oxygen-free nitrogen gas was passed through inlet and outlet tubes at an adjusted flow rate. At the end of experiment, the boat was withdrawn, the reaction products leached out with 1:1 HCl, and the dissolved proportions analysed.

The paper contains a detailed discussion of the results obtained.

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