171

Decomposition of ilmenite by ZnO/ZnS: Enhanced leaching in acid solutions

N. D. H. Arachchi[a], G. S. Peiris[b], M. Shimomura[c] and P. M. Jayaweera[a]*

[a] *Department of Chemistry, University of Sri Jayewardenepura, Sri Lanka.*

[b] *School of Chemistry, Physics and Mechanical Engineering, Queensland University of Technology, Brisbane, QLD 4001, Australia.*

[c] *Research Institute of Electronics, Shizuoka University, 3-5-1 Johoku, Naka-ku, Hamamatsu, Japan.*

Abstract

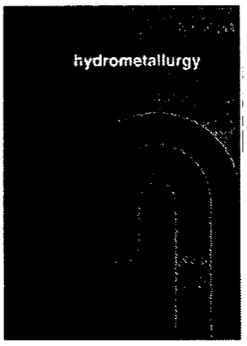
Acid leaching of ilmenite ($FeTiO_3$) obtained from beach sand was found to be more effective when roasted with ZnO or ZnS at 900 °C. Remarkably higher iron and titanium leaching rates were observed when compared with normal ilmenite in 5.0 M HCl at 30 °C and 6.0 M H_2SO_4 at 110 °C, respectively. Roasting of ilmenite with ZnO or ZnS converts acid resistant $FeTiO_3$ to more reactive Fe_2O_3 and Zn_2TiO_4, resulting in enhanced leaching. Roasting $FeTiO_3$ with ZnS generates SO_2 as a byproduct, which can be used to produce H_2SO_4 acid required in the sulfate process. Added ZnO or ZnS can be recovered as ZnO, therefore the overall process acts as a catalytic decomposition of $FeTiO_3$. Ores containing ZnS, such as sphalerite, are possible raw materials instead of ZnS, in a commercial application. XRD analysis confirms the formation of zinc titanate, and XPS results indicate the presence of both Fe^{2+}/Fe^{3+} in naturally weathered ilmenite.

Keywords: Ilmenite, XPS, XRD, acid leaching, roasting, ZnO/ZnS.

1. Introduction

Ilmenite ($FeTiO_3$) is the most abundant titanium-bearing mineral used for the production of titanium dioxide (TiO_2) through hydrometallurgical and pyrometallurgical processes (Zhang et al., 2011b). Rutile, ilmenite, and leucoxene are the three main titanium-bearing minerals. Because ore deposits with high rutile content are depleting, the demand for natural ilmenite, such as that present in beach sand, will continue to dominate in the titanium industry. TiO_2 is extensively used as a pigment in pharmaceutical, paint, textile, food, ceramic, and paper industries (Abdel-Aal et al., 2000). The three main crystalline forms of TiO_2 are rutile, anatase, and brookite (Yanqing et al., 2000). Anatase is widely used as a photocatalyst in semiconductor applications (Gázquez et al., 2014), and, brookite is the least

(172)



Accepted Manuscript

Decomposition of ilmenite by ZnO/ZnS: Enhanced leaching in acid solutions

¡!–[INS][N. D. H.]–¿N.D.H.¡!–[/INS]–¿ Arachchi, ¡!–[INS][G. S.]–¿G.S.¡!–[/INS]–¿ Peiris, M. Shimomura, ¡!–[INS][P. M.]–¿P.M.¡!–[/INS]–¿ Jayaweera

PII: S0304-386X(16)30630-2
DOI: doi: 10.1016/j.hydromet.2016.09.001
Reference: HYDROM 4430

To appear in: *Hydrometallurgy*

Received date: 29 January 2016
Revised date: 14 June 2016
Accepted date: 6 September 2016