

Contents

1	Introduction and Preview	1
1.1	Introduction	1
1.2	Plasma	1
1.2.1	Types of Plasma	2
1.2.2	Thermal Plasma	3
1.2.3	Properties of Thermal Plasma	5
1.2.4	Non-transferred Arcs	6
1.2.5	Transferred Arcs	6
1.2.6	The Extended Arc	6
1.3	Thermal Plasma Processing	6
1.4	Advantages of Plasma Processing and Its Industrial Applications	10
1.4.1	Fine Particle Feed Capability	10
1.4.2	Independent Energy Source	10
1.4.3	Gas Environmental Control	11
1.4.4	High Temperatures	11
1.4.5	High Energy Fluxes	11
1.4.6	High Throughput	11
1.4.7	Gas Flow Rate Control	11
1.4.8	Electrical Energy Intensive	12
1.4.9	Rapid Response	12
1.4.10	Low Electrode Consumption	12
1.4.11	Control of Refractory Consumption	12
1.4.12	Low Noise Level	12
1.5	Titanium-Bearing Minerals and Its Chemical Processing	13
1.6	The Mineral Ilmenite	15
1.6.1	The Physical Characteristics of Ilmenite	16
1.6.2	Ilmenite: (Fe TiO ₃)	16
	References	17

2	Plasma Melting Studies on Static Bed Reactor	19
2.1	Introduction	19
2.2	Experimental	21
2.2.1	Effect of Variation of Experimental Conditions	22
2.2.2	Static Bed Plasma Reactor	24
2.3	Pre-reduction/Metallization of Ilmenite	25
2.3.1	Reduction Temperature	25
2.3.2	Residence Time	26
2.3.3	Amount of Reductant	26
2.4	Plasma Melt Separation	27
2.4.1	Amount of Reductant in the Pre-reduced Ilmenite	27
2.4.2	Effect of Time on Plasma Melting	27
2.4.3	Effect of Input Power on Plasma Melting	27
2.4.4	Effect of Extent of Pre-reduction on Plasma Melting	27
2.5	Discussion	28
2.6	Conclusion	30
	References	31
3	Plasma Melting Studies on Moving Bed Reactor	33
3.1	Introduction	33
3.2	Experimental	34
3.3	Result and Discussion	34
3.3.1	Effect of Power	34
3.3.2	Effect of Speed	36
3.4	Discussion	39
3.4.1	Effect of Speed	40
3.4.2	Effect of Degree of Metallization	40
3.4.3	Effect of Power	40
3.5	Conclusion	41
	References	41
4	Leachability Studies on Slag	43
4.1	Introduction	43
4.2	Experimental	44
4.3	Results and Discussion	45
4.3.1	Effect of Mineral Acid	45
4.3.2	Effect of Concentration of HCl	45
4.3.3	Effect of Experimental Processing Parameters	45
4.3.4	Effect of Additives	46
4.3.5	Effect of Heat Treatment	46
4.3.6	Effect of Different Amount of Ethylene Glycol	47
4.3.7	Effect of Time	47
4.3.8	Analysis of Residue of the Leached Slag	47

4.4	Chemical Analysis of the Slag	48
4.5	Conclusion	52
	References	52
5	Computer Studies on Statistical Analysis of Data	53
5.1	Introduction	53
5.1.1	Objectives	54
5.2	Optimization of Titanium-Dioxide-Rich Slag Production Using Statistics Bases Experimental Design in a Moving Bed Reactor	55
5.2.1	Experimental Methods	56
5.2.2	Results and Discussion	57
5.2.3	Conclusion	61
5.3	Studies on Leachability of Ti-Rich Slag Obtained from Plasma Melt Separation of Metallized Ilmenite	63
5.3.1	Parameters Studied	68
5.3.2	Conclusion	72
5.4	A Conclusion and Perspective in Future Scopes	74
	References	74
6	A Conclusion and Perspective in Future Scopes	77
6.1	Static Bed Reactor	77
6.2	Moving Bed Reactor	78
6.3	Leaching Behavior	78
6.4	Computer Studies on Statistical Analysis of Data	78
6.5	Future Scope	79
	References	80

<http://www.springer.com/978-3-319-70732-7>

Thermal Plasma Processing of Ilmenite

Samal, S.

2018, VII, 80 p. 21 illus. in color., Softcover

ISBN: 978-3-319-70732-7