CHAPTER I

INTRODUCTION

Flash smelting is a pyrotallurgical process for smelting metal sulphide concentrates developed in the 1940s by Outokumpu Oy in Finland. It is used primarily for copper sulphide concentrates, but is also used for nickel sulphide concentrates, Ni-(Cu)-Fe-S. There are two kinds of flash smelting furnace, the Outokumpu Flash Furnace (Figure 1.1) and Canadian International Nickel (Inco) Flash Furnace (Figure 1.2).

The Outokumpu flash furnace is the most common type, with over 30 Outokumpu furnaces in operation. While most of these are being used for smelting Cu-Fe-S concentrates, there are five furnaces being used to smelt Ni-(Cu)-Fe-S concentrates. The companies and their locations are shown in Table 1.1.

The Inco flash furnace at Sudbury has been tested for Nickel smelting (Solar et al., 1985), and is now in operation.

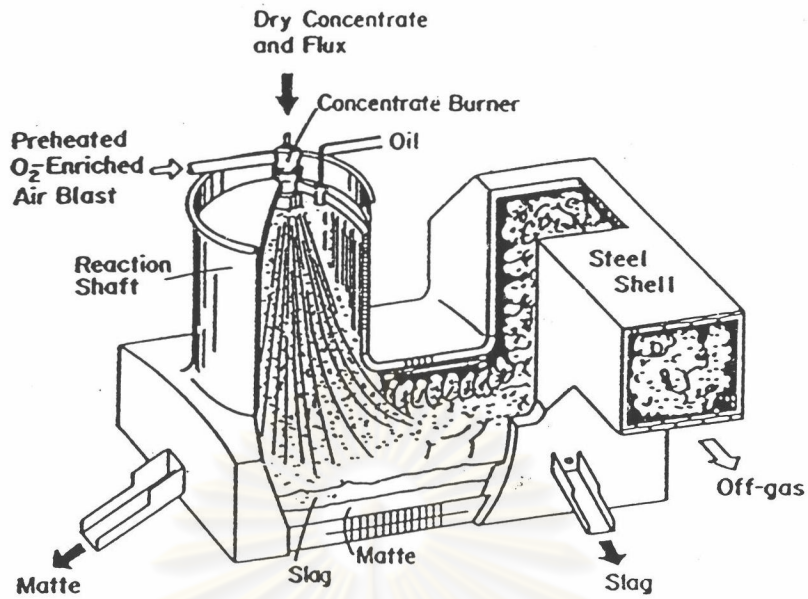

Figure 1.1 Outokumpu Flash Furnace (Davenport et al, Flash Smelting, 1984).

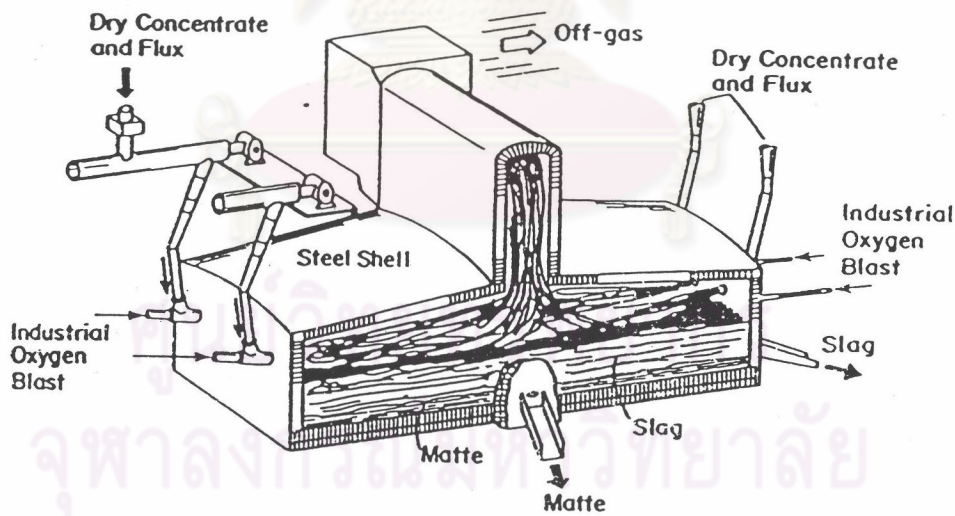

Figure 1.2 Inco Flash Furnace (Davenport *et al.*, Flash Smelting, 1984).

Table 1.1 Nickel concentrate Flash Smelters

Company Name	Location
BCL, Limited	Selebi-Phikwe ,Botswana
Kombinat Norilsk	Norilsk , USSR
Outokumpu Oy	Harjavalta , Finland
International Nickel	Copper Cliff, Canada
Western Mining Co., Ltd.	Kalgoorlie, Australia

The main raw materials of nickel flash smelting are dry nickel concentrates, flux, air and industrial oxygen. The nickel content of dry nickel concentrate is lower than the copper content of copper sulphide concentrates, Table 1.2. Flux is included in the feed to the furnace to react with the iron oxides formed during smelting to create a molten slag which can be easily removed from the furnace. The industrial oxygen used in flash smelting contains 90-98 mass % oxygen. The main benefits of using industrial oxygen in the Outokumpu flash furnace are;

i. saving fossil fuel (less nitrogen has to be heated in the furnace)

ii. the volume of gas passing through the furnace is decreased.

Table 1.2 Example of Nickel and Copper Flash Smelting Concentrates

Concentrate	%Ni	%Cu	%Co	%Fe	%S	Others
Copper	-	28	-	25	30	17
BCL Limited	2.9	3.4	0.2	46	30	18
Outokumpu Oy	9	3	0.3	34	25	29
Western Mining	12	0.8	0.2	37	32	18

In the case of the Kalgoorlie nickel flash smelting furnace, accretions build up on the walls and roof during furnace operation. The physical characteristics and chemistry of accretions have been studied by some metallurgists. A review of the literature relating to the flash furnace, the atmosphere in the furnace and accretion structure and chemistry will be given in Chapter 2 (literature review). Chapter 3 lists the objectives of the project. Chapter 4 describes the experimental method used for inspecting the microstructure of the accretions and recreating accretions in the laboratory . The results of the experiments are given in Chapter 5. These results are discussed in Chapter 6 and summarised in Chapter 7, which also gives recommendations for future work.