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RECENT DEVELOPMENTS IN SLAG-FUMING PROCESS(*)

S.K.Das & S. Sarkar,
Regional Engineering College,
Durgapur.

In earlier attempts at recovering zinc from lead blast-furnace slag, the idea of reducing zinc oxide to metallic zinc and then reoxidising to zinc oxide was not considered. The first slag-fuming plant was started is East Helena, Montana, in 1927. Several slag treatment furnaces are now in operation. Developments in the slag-fuming process have been reported e.g. 1) the cyclone furnace 2) suspension smelting and volatilization.

Molten slag from the blast furnace and cold slag from the dump is charged to a furnace, water jacketted on all sides except the roof, which is arched over with brick; an outlet leads to a flue containing waste heat boilers. Pulverised fuel and air are admitted through tuyers on each side of the furnace under pressure. The amount of air supplied is the minimum required to burn coal to carbon monoxide since the reduction of zinc oxide is more efficiently performed by the monoxide than the solid carbon or the dioxide. Treatment of the slag is divided into a charging period, a blowing period and a tapping period, the whole cycle being completed in about two hours. At first, elimination is slow but on reaching 1000°C, the process accelerates and continues rapidly until the zinc content of the slag is reduced to about 1 percent, the extraction being 93-94 percent.

The mixture of metal vapour and condensed oxide fume above the slag bath is carried by the flow of combustion gases into the combustion chamber of the waste heat unit. Along this patch of flow, via a horizontal flue prior to entering the boiler, oxidation of

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the metal vapour and the combustion of carbon monoxide takes place. The dust laden air leaves the furnace at about 1100°C and enters the waste heat boiler at 1000°C. In its passage through the unit, the temperature is reduced to 400-500°C. Further cooling is effected by water-sprayed cooling towers and at 200°C the fume enters the bag-house. The dust collected in the waste heat unit, flues, cooling towers and bag-house is mixed. The mixed fume assays 63-70 percent Zn and 5-10 percent Pb.

The fume is treated in a kiln with about 1.5 percent coke breeze. Two products are obtained; the de-leaded fume is then discharged from the kiln and is cooled in water-cooled rotating coolers and sorted for shipment to the zinc smelter. This product assays 72 percent Zn and 1.5 percent Pb. The gases from the kiln, containing PbO, enter the lead bag-house through cooling chambers. The dust obtained from lead bag-house assays 50 percent Pb and 23 percent Zn and is returned to the lead smelting system.

There has been some difference of opinion among research workers as to whether elemental carbon or carbon monoxide is the active reducing agent in the slag-fuming process. Some workers also noted that high -volatile coals seem to be more efficient than the low -volatile coals indicating that hydrogen could also be an active reducing agent. However, in experiments carried out by Bell, Turner and Peters, it was found that both hydrogen and carbon monoxide are effective reducing agents for the zinc oxide content of the slag. Other views were expressed by Quarm and Kellogg.

The main disadvantages in the conventional slag-fuming processes are 1) a higher fuel consumption than is required for the zinc oxide reduction and 2) maintainance of a high proportion of CO during the end of the blow. To overcome these disadvantages, Blanks and Ward developed a cyclone furnace for the treatment of slag. The excess heat is used for flash smelting the cold granulated slag. The design of the furnace is such that the gases are given a swirling motion and through the cyclone action the molten slag is thrown to the walls of the furnace. The molten slag runs down into the slag bath counter current to the rising reducing gases. A high degree of thermal efficiency and zinc elimination was achieved in this process.

Lange and Barthel developed a suspension smelting process for the fuming of the blast furnace slag. The process aimed at having high yields per unit space and time. Increasing mass and heat transport and transfer by satisfying the aerodynamic requirements in the reaction space and appropriate design are the essential requirements for high space-time yields in metal recovery processes by volatilization. These objectives were achieved by using a special burner and furnace construction developed by the authors.

It is reported that the Indian lead smelter of Hindustan Zinc Ltd. at Tundoo, Dhanbad has about 50,000 tons of cold slag in the slag dump. The slag contains on an average 2.56 percent lead and 11.46 percent zinc. Over and above this reserve of cold slag, a yearly production of 6000 tons of slag is expected. The installation of a slag treatment plant in the country for the recovery of lead and zinc from the indigenous source of lead blast furnace slag is recommended.

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