

Dust and Sludge Recycling with the Rotary Hearth Furnace

1. Introduction

The dust and sludge generated from the steelworks are composed mostly of iron and carbon. Recycling dust and sludge is beneficial because they reduce iron ore and coke consumptions. However, due to the limitations of zinc content in the dust and sludge, their complete recycling has so far been difficult.

Nippon Steel has been taking active steps to solve this problem by providing a better solution. In 1999, the Steel Plant & Environmental Engineering Division introduced a rotary hearth furnace (RHF) process from Maumee Research & Engineering, U.S., and installed its first RHF plant in the Hikari Works of Nippon Steel & Sumikin Stainless Corporation. Furthermore, the Steel Plant & Environmental Engineering Division, in collaboration with other related Nippon Steel divisions, developed the technology to process high-water-content sludge, which had previously been difficult to treat for economic and technical reasons and greatly contributed to the commercialization of the No.2 RHF plant installed at Kimitsu Works of Nippon Steel.

2. Treatment of Dust and Sludge by RHF

The RHF process produces directly reduced iron (DRI) utilizing coal and iron bearing material like iron ore. Dust and sludge produced from the steelmaking process are agglomerated to a suitable size for reduction, and are charged into the RHF. In the RHF, which is heated to high temperature by the combustion heat of burners, agglomerated raw materials are reduced using the carbon content as a reducing agent. At this time, the zinc is removed from agglomerated raw materials through reduction and gasification, and is collected as secondary dust. On the other hand, the remaining iron content can be recycled as a high-metallization DRI in a blast furnace and melting furnace because of the low zinc content.

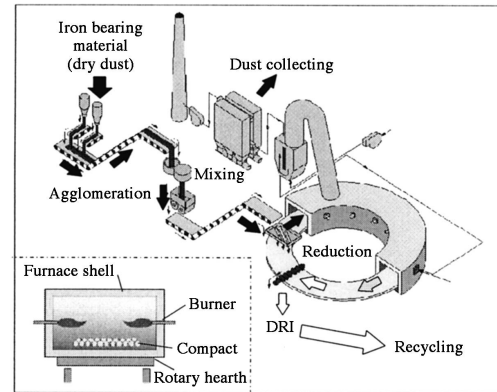
3. Direct Processing by RHF of High Water Content Sludge

- The newly developed RHF process has the following features:
- * Capability to treat sludge with widely varied characteristics, that is not significantly affected by its characteristics
 - * Environmentally clean with little dust generation by eliminating the drying process
 - * Compact equipment structure

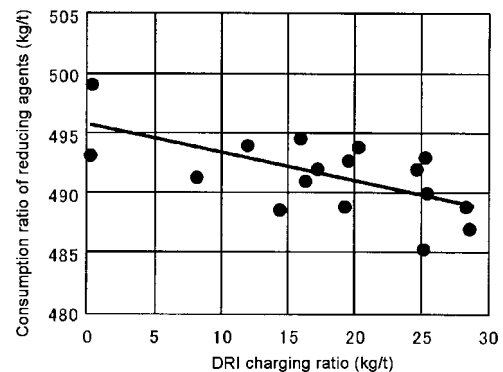
4. DRI Quality and Merit

It has been verified that the DRI produced by the new RHF technology can lower the reducing-agent rate in the blast furnace because of its reducing effect. The DRI produced from the newly developed RHF process also has sufficient qualities for recycling in the blast furnace as shown in the table below.

(For further information, contact
Steel Plant & Environmental Engineering Division)



Basic RHF process



Effect to decrease reducing agent ratio of blast furnace

Product DRI properties

Item	Actual figures
Crushing strength (kg/cm ²)	100
Dezincing ratio (%)	80 - 90
Reduction ratio (%)	70 - 80
Total-Fe (%)	70 - 75
Total-Zn in secondary dust (%)	50 - 60



Over view of Kimitsu No. 2 dust recycle plant