REIMAGINE

CASE STUDY

HARSCO ENVIRONMENTAL

I PLASMA FURNACES

ENABLING STEELMAKERS TO PROPERLY DISPOSE OF DUST STREAMS

Electric Arc Furnace

Production of stainless steel presents challenges to clients including high disposal costs, loss of valuable elements and landfill shortages that may require operational shutdowns. Harsco presents an innovative solution.

BACKGROUND

During the production of stainless steel, about 25-30kg of fine dust is generated by the Electric Arc Furnace (EAF) and Argon Oxygen Decarburization (AOD) processes, per ton of steel produced.

This dust stream, collected by the primary and secondary Steel Melt Shop de-dusting systems, contains valuable alloy elements such as nickel, chromium, molybdenum, manganese, iron and zinc in their oxide forms. The downside: the dust steam is classified as a hazardous waste, requiring the steelmakers to properly dispose of it if not valorized.

Disposal costs have increased significantly during the past several years, costing clients approximately 300–350€/ton or more depending on landfill availability. As facilities can only maintain a limited volume of this waste on site, as a temporary deposit, any landfill shortage may result in an operational shutdown if disposal cannot be accommodated.

.

REIMAGINE

CASE STUDY

HARSCO ENVIRONMENTAL

Plasma arc furnace process being controlled by operator

THE SOLUTION

Harsco introduced a solution based on the process of operating a carbothermic reduction of the metallic oxides included in the dust. The solution is powered by a DC plasma furnace, which creates a high temperature plasma-arc in a plasma forming gas (e.g., nitrogen). A single cathodic graphite electrode provides the heat needed for this process.

The waste is melted by the plasma arc to form two layers: an upper molten slag layer containing the oxides, and a lower molten metallic layer. Fluxing additions are incorporated as needed to ensure the slag is molten at suitable furnace operating temperatures, has a low viscosity and is compatible with the refractory lining of the furnace.

The process adds Carbon reductant to the waste before the "feed" enters the furnace to reduce the target metals from their oxides and form a ferroalloy in the base of the furnace. The furnace is typically constructed with a conductive hearth of steel clad carbon-impregnated magnesia bricks on top of a copper anode plate as a return electrode for the plasma current. The slag line is lined with suitable refractories and surrounded by water cooled copper cooling panels to minimize the erosion by the molten slag and metal. The remainder of the furnace is water-cooled and lined with refractory materials selected for thermal efficiency, security of containment and length of operation between refurbishment or replacement. The furnace exhaust gases are treated in a standard off-gas abatement system to comply with local emissions standards.

OUTCOME

Enabling the proper disposal of dust streams is benefitting customers and helping them avoid shut downs as a result of overcommitted landfills.

For more information on the costs and implementation of this solution, please contact us at **hem@harsco.com**

STATUS

Harsco is successfully processing the dust in Italy; recovering base metals and

delivering a net benefit of about 300€ per ton

of dust processed over an annual volume of 22.000 ton.

37%

The metallic yield achieved is in the range of 35-37%

and the cast iron-alloy contains 17-18 percent chromium, five to six percent nickel, one to 1.5 percent molybdenum and one to two percent manganese.

The Plasma Furnace dedusting system collects about 15 percent of dust,

of which 55-60 percent is zinc oxide.

The average energy requirement, including furnace heat losses, is about 1.7 MWh/ ton of dust, while

the process needed power it is about 6 MW DC.

MAKING A WORLD OF DIFFERENCE™

Harsco Environmental, Harsco House, Regent Park,
299 Kingston Road, Leatherhead, Surrey KT22 7SG, United Kingdom t 44 (0) 1372 381400

© 2020 Harsco Corporation. All Rights Reserved. This document and the information set forth herein are the property of Harsco Corporation.