Recarc - Recycling of residues from metallurgical industry with the arc furnace technology

LIFE03 ENV/D/000043

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Project description:

Background

In 1997, 5.7 million tonnes of stainless steel was produced in Europe. The main producers are located in Italy, Spain, Finland and Germany. During the manufacturing of stainless steel, solid residues of filter dust and slag are generated. The filter dust amounts to 1 – 3 % of the input (120,000 tonnes/yr); it is treated in plasma furnaces in the presence of coke. The main products are recycled metals and a material which is used as rock fill. Stainless steel production generates two types of slags: EAF (Electric Arc Furnace) slags and AOD (Argon Oxygen Decarburization) slags. These slags contain a high amount of chromium as well as some nickel and manganese. The slag amounts to 15 - 20 % of the input (app. 800,000 – 1,100,000 tonnes/yr). There are few practical applications for the slag due to a risk of heavy metal leaching and water pollution. The transmission of hexavalent chromium into the environment poses a risk of cancer in human beings and animals and adversely alters the genetic diversity of species. Moreover, the AOD slag is normally disintegrated into a powder due to the volume expansion that occurs during cooling. This not only limits its application as a construction material, but it also creates an unpleasant working environment and represents a loss of valuable raw materials. Thermochemical treatment in an arc furnace would enable a separation of the different fractions.

Objectives

The goal of this LIFE project, entitled RECARC, was to recover completely the heavy metal fraction of the residue (slag) resulting from the production of stainless steel and to convert the mineral fraction to a high-value building
material. This was to be achieved by using a thermochemical treatment in an arc furnace. The objectives of the project were: 1.) Demonstration on a technical scale of thermochemical treatment of residues (slags) from steel and stainless steel production. 2.) Production of a pure metallic fraction for recycling. 3.) Production of a slag with low concentrations of heavy metals, so that the mineral fraction can be used as a building material.

Results

The RECARC project successfully demonstrated a complete recycling of AOD slag generated from stainless steel production using a thermochemical treatment process. The highly innovative project resulted in the separation of two fractions: a chromium-rich metal fraction and a mineral fraction. In total, 5 tonnes of AOD slags were used for tests during the project. They were treated thermochemically in the beneficiary’s 300 kW alternating current arc furnace under “reducing conditions”. The high temperature process facilitated the separation between the molten slag and the liquid metal fraction, which sinks down due to its higher density. For the separation of both fractions the mineral phase is decanted, while the metal phase remains in the furnace. To optimise the reduction of the chromium compounds, the beneficiary investigated different melting conditions with (1) long arc, (2) short arc and (3) resistance melting, in each case with and without reducing agent. The project results showed that the reduction efficiency is highest when melting in resistance. Here more than 90% of the bonded chromium will reduce to the elemental form with additional reducing agents like petroleum coke (carbon) or aluminium, resulting in Cr2O3-amounts in the mineral fraction of This project has been selected as one of the 21 "Best" LIFE Environment projects in 2007-2008

Environmental issues addressed:

Themes

Industry-Production - Metal industry
Waste - Industrial waste

Keywords

residue recycling, iron and steel industry

Target EU Legislation

• Waste
Natura 2000 sites

Not applicable

Beneficiaries:

Coordinator Bundesanstalt für Materialforschung und -prüfung
Type of organisation Research institution
Description The beneficiary, Bundesanstalt für Materialforschung und –prüfung (BAM), is a Federal Institute for material research and testing, based in Berlin, Germany.

Partners Forschungsgemeinschaft Eisenhüttenschlacken e.V., Germany

Administrative data:

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Project location Nordrhein-Westfalen (Deutschland)
Berlin (Deutschland)

Read more:

Project web site Project's website (DE, EN)
Publication: Layman report Title: Layman report (EN) Year: 2006 No of pages: 8
Publication: Layman report Title: Layman report (DE) Year: 2006 No of pages: 8
Video feature Title: Video of the project (EN) Year: 2006 Editor: BAM, Berlin