Project description:

Background

Hot rolling is a process for working metal into particular forms, notably sheets or rods. Large pieces of metal are heated and then passed between rollers which generate thinner cross-sections. Hot rolling is able to produce greater deformations of the metal than cold rolling for the same number of rolling cycles and typically avoids residual stress building up in the material.

However, hot rolling of steel leaves a layer of scale on the surface. The scale forms as the steel reacts with the atmosphere on cooling from its high temperature. Scale on the surface can cause significant problems for subsequent use and coating of the steel.

For decades, descaling of steel has been performed by precrushing the scale and then removing it in a pickle with hot hydrochloric and sulphuric acid - dip or spray pickling. After pickling, the strip is rinsed, dried and oiled.

This process has a significant environmental impact. The process uses large amounts of polluting and potentially dangerous acids. The handling of hot mineral acids results in noxious contamination of indoor air. Furthermore, water consumption of the rinsing and cooling processes is high.

The steel industry is considered one of the most conservative sectors. Core technologies have not changed for many decades and equipment lasts for a lifetime.
Objectives

This highly ambitious LIFE project aimed to radically change the steel industry by demonstrating an effective process at industrial scale for replacing the existing chemical process for descaling steel with a 100% physical process.

The project hoped to demonstrate that it was possible to achieve excellent descaling results with a process that relied on physical abrasion and a high-pressure vacuum. It would also use the removed scale as an abrasive in further descaling cycles, improving the sustainability of the process.

Ultimately, the project sought to remove the use of chemicals from the descaling process, thus avoiding its associated environmental dangers.

Results

The HVD project is a genuine LIFE success story. It demonstrated an effective hydro-mechanical process for descaling steel, which can replace an environmentally damaging chemical process. According to steel industry experts, the technology developed may be the most innovative optimisation in the steel industry within the last 40 years.

The developed process blasts abrasive particles onto the scale-coated steel with high-pressure water jets. The mixture of scale: water is about 1:6 by volume - or 1:2 by weight - with about 70 litres of the mixture being applied per minute. The resulting water-scale suspension is sucked off under vacuum. After descaling, the water and scale are separated in a simple procedure. Both media may then be reused in the next cycle of the same process; the scale is used as an abrasive medium.

The project beneficiary, Airmatic, successfully scaled up and optimised its high-pressure-vacuum (HVD) technology for descaling steel. The results demonstrated that the technology is suitable as a complete substitution of pickling in cases where 95% removal of the scale is sufficient or as a pre-pickling stage to reduce pickling by at least 50% where greater reduction is needed.

The new process has significant economic and environmental benefits. In all cases, the physical descaling process reduces consumption of water, use of pickling chemicals and heating gas by at least 50%. Often, the reduction is between 70 and 80%. In cases where no further pickling is needed - for example with construction steel which is zinc coated afterwards - the savings are 100%.

The HVD technology itself has very little negative environmental impact. The water is circulated back through the system and the scale for blasting, a waste product of the process, is reused as an abrasive medium. The main environmental impact is only the electricity needed - mainly for the high-pressure pump.

The market for the technology covers around 600 plants worldwide and the interest of the steel industry in the new technology is already very high. As of June 2009 about 12 different steel types from five companies had been tested. In all cases the tests were successful: the particle size of scale is now less than
50ym and reduction of pickling time is always greater than 50%.

Further dissemination of the technology is encouraged by the clear economic incentives for the beneficiary and the involvement of Sundwig - a supplier of steel industry equipment. The fact the demonstration plant has been set up at the beneficiary's premises is also important as it ensures access is open for any interested steel company to see demonstrations of the technology and run tests on their own type of steel.

Further information on the project can be found in the project's layman report (see "Read more" section).

Top

Environmental issues addressed:

Themes

Industry-Production - Metal industry
Environmental management - Cleaner technologies
Air & Noise - Air quality monitoring

Keywords

clean technology, industrial process, iron and steel industry

Target EU Legislation

- Water
- Waste
- Industry and Product Policy
- Air
  - Directive 84/360 - Combating of air pollution from industrial plants (28.06.1984)

Natura 2000 sites

Not applicable

Top
Beneficiaries:

Coordinator: Airmatic GmbH
Type of organisation: SME Small and medium sized enterprise
Description: Airmatic is a small company engaged in the development of innovative high-pressure and high-vacuum technologies for cleaning and fire extinguishing.

Partners: Universität Siegen-Lehrstuhl für Energie- und Umweltverfahrenstechnik (LEUVT), Germany

Administrative data:

Project reference: LIFE05 ENV/D/000207
Duration: 01-DEC-2005 to 31-MAY-2009
Total budget: 1,907,000.00 €
EU contribution: 536,100.00 €
Project location: Nordrhein-Westfalen (Deutschland)

Read more:

Publication: Layman report
Title: Layman report (DE) Year: 2009 No of pages: 6
Publication: Layman report
Title: Layman report (EN) Year: 2009 No of pages: 6