Retrofitting equipment for efficient use of variable feedstock in metal making processes

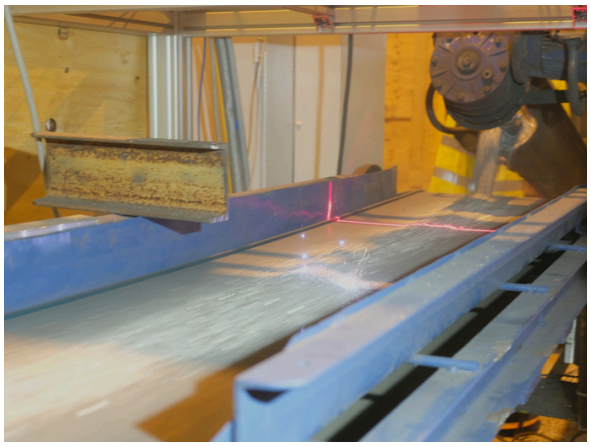
Results in Brief

Retrofit sensors and advanced process control enable reuse of low-quality metal scrap

High-tech sensors for metal scrap characterisation together with decision support and process control tools are helping energy-intensive metal manufacturers reduce their environmental footprint.

INDUSTRIAL TECHNOLOGIES

ENERGY



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European process industries, particularly energy-intensive industries (EIIs), consume tremendous amounts of energy and raw materials. In the metal making industry, recycling and reusing scrap metal can reduce both significantly. However, the industry faces challenges in processing increasingly variable metal scrap while ensuring an efficient use of energy and resources.

The EU-funded REVaMP project set out to address these issues with sensor technologies, decision support systems, and process monitoring and control tools. They helped the metal industry characterise their scrap – in bulk form for the first time – and process it accordingly to achieve high quality products with less materials and energy.

High-tech sensors enable metal scrap analysis in bulk form

Reforging metal is likely the world's oldest recycling practice – in use for more than 2 000 years. Today's metal processing plants use metal scrap as a secondary raw material in their melting processes. It is highly variable in composition, so manufacturers favour more expensive scrap types with known properties or even primary raw materials to ensure the quality of their final recycling products.

According to project coordinator Bernd Kleimt of BFI: "REVaMP developed in-line sensors based on prompt gamma neutron activation analysis (PGNAA) and on laser-induced breakdown spectroscopy (LIBS). PGNAA and LIBS were used for bulk analysis of metal scrap in large containers, for example trucks – something that had never been tried before." Together with statistical methods developed by the project partners, the sensors allowed a comprehensive characterisation of the scrap types in use. This will enable industries to use more of the cheaper, low-quality scrap while maintaining product quality.

Sensors and ICT tools save energy and materials

"REVaMP's decision support systems determine the charge mix (material input to the furnace) with minimum costs for a given desired product quality using the actual characteristics of the scrap materials used. Our model-based control systems enable dynamic adaptation of energy and material inputs to meet the needs of each individual melt. This reduces the energy and resources used by the scrap melting furnaces," explains Kleimt.

In all three use cases – scrap-based electric steelmaking, aluminium refining and lead recycling – the use of the optimal charge mix tool and the model-based control system reduced energy consumption, emissions, materials' use, and the cost related to the materials. For example, in the aluminium refining sector, the melting furnace's natural gas consumption was reduced by about 15 % and CO2 emissions by about 5 %. In addition, the costs related to pure alloy consumption were reduced by 3-18 %. Optimised selection of lead bullion in the lead recycling sector led to savings in alloy materials of about one tonne per year.

Easy replication in other EIIs

Most of the developed retrofitting technologies can be applied in other EIIs that use secondary raw materials as feedstock, either directly or with small adaptations.

Kleimt concludes: "REVaMP's outcomes strengthen the circularity of the metal

making industry by enhancing the use of metal scrap and other metallic residues. The savings in primary raw materials and energy as well as production-related CO2 emissions will help the EU fulfil its commitments in the context of the European Green Deal.”

Keywords

REVaMP | metal | energy | metal scrap | sensors | recycling | energy-intensive industries | process industries | PGNAA | LIBS | process control

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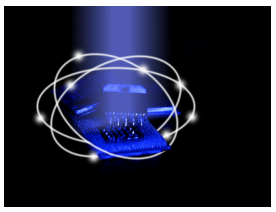

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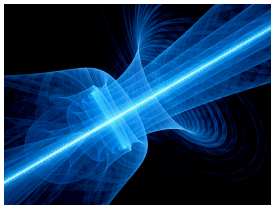

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REVaMP

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