Press Release

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New recycling process can reduce up to 800.000 tons of CO_2 emissions in Europe per year

In the Horizon Europe project ReSoURCE, SINTEF and Norsk Elektro Optikk AS (NEO) scientists, together with partners from 5 countries, are developing a sensor-based system for the recycling of refractory products, striving to reduce Europe's carbon emissions significantly.

Extractive industries, including refractory raw material production, are responsible for a significant part of the world's carbon emissions and has a strong impact on the loss of biodiversity. Establishing a circular economy and developing an efficient recycling process for this industry is essential to reduce CO2 emissions in Europe, as well as preserve natural resources.

- Refractory products for industries using high-temperature processes, such as cement-, glass- and steel industry, are precisely adapted to the needs of each individual customer. Since many different products are used in each application and get mixed after treatment, this is a challenge for the recycling, explains Alexander Leitner from RHI Magnesita, the company that coordinates the project Refractory Sorting Using Revolutionizing Classification Equipment project (ReSoURCE).

- Gaining the raw material for refractory products is in general CO_2 intense, RHI Magnesita invests to improve the recycling process. With ReSoURCE we hope to be able to save up to 800.000 tons of CO_2 emissions in Europe per year.

The research institute SINTEF contributes with its know-how in powder technology and sorting solutions for powder materials to develop novel solutions for sorting fine-grained refractory waste materials.

- We are delighted to bring our more than 40 years of experience in developing lab, pilot, and industrials scale solutions in powder science and technology to this important research initiative, states Akhilesh Kumar Srivastava, project leader and senior research scientist at SINTEF Industry.

Using cutting-edge technology to study recycled materials

The largest independent research and development organization in electro optics in Norway, Norsk Elektro Optikk (NEO), is contributing with its technology in hyperspectral imaging (HSI) to the project.

- "Hyperspectral imaging is used across different industries to characterize surface compositions and quality changes of materials", says Friederike Koerting from NEO. She's the geological hyperspectral expert at NEO.

- HSI enables us to optically inspect different materials using a wider spectral range than what the human eye allows. In this way we can detect changes between different minerals and mixtures based on their distinctive spectroscopic properties, allowing us to identify and highlight changes between recycling materials. HSI also has real-time material classification and machine vision capabilities aiding the sorting process.

- With this cutting-edge technology, we will be able to deliver material information from each location on the conveyor belt, which is crucial for a precise selection process.

Creating a multi-sensor sorting unit
The biggest challenge in recycling refractory products is the precise sorting of the different used materials consisting of a mixture of different chemical components. Being able to split (segregate) the components and sort them into different quality groups is crucial for the quality of future products created from these recycled secondary raw materials.

ReSoURCE is in the process of developing a solution for this by creating a multi-sensor sorting unit. Different types of optical sensing technologies can be used to sort out components in refractory materials. The unit combines laser-induced breakdown spectroscopy (LIBS) and hyperspectral imaging allowing for an element and material classification.

- “With our technology and the solutions developed by project partners, the used material on the conveyor belt will be analyzed and classified automatically. We have already seen in our first tests in the laboratory that the components we are working with can be distinguished with higher precision than that of the manual sampling”, reports Koerting.

Sorting particles down to below 1-5 mm
The new unit should be able to manage the sorting of particle sizes down to 1–5-millimeter scale, also known as fine fractions.

- “In refractory recycling, the fine fractions are mostly used as landfill. The challenge is to recover these fine fractions from the refractory waste through direct sorting methods”, adds Chandana Ratnayake, chief scientist at SINTEF Industry.

With the goal of a green and digital transformation of the refractory recycling value chain, the project ReSoURCE will innovate the entire recycling industry in the European refractory industry. When the project reaches its targets, it can contribute to massive annual CO_2 reductions, up to 800 (kilo) tons per year, and energy savings of up to 760 GWh per year.

Background Information

The ReSoURCE project goal is the development of a sensor-based demonstrator system for refractory waste sorting and powder handling. If the project is successful, it will enable the robust engineering of automated sorting equipment that will increase the recycling of refractory breakout material from the current estimate of 7–30% (plus 10% of downcycling, which means that the recycled materials will be used to other functionality than refractory products) to a total of 80%. With approximately 28 million tons of used refractories generated annually, the ecological and societal benefits will be considerable.

The project is funded by the European Health and Digital Executive Agency (HaDEA) in the Horizon Europe Framework program (HORIZON) under the grant agreement number 101058310. The total budget is € 8.5 million. €6 million EU are funded by the EU, €1 million by the UK. The project's duration is from 06/2022 - 11/2025 (42 months). The consortium consists of 9 members (4 academia / 5 industry). Partners come from Austria, England, Germany, Ireland and Norway. The project is led by RHI Magnesita. Other partners involved in the project are LSA GmbH (GER), Fraunhofer Institute ILT (GER), SINTEF (NOR), Montanuniversitaet Leoben (AT), Innolas Laser GmbH (GER), NEO (NOR), CPI (UK) and Crowdhelix (IRE).

Visuals

The project uses Laser-Induced Breakdown Spectroscopy (LIBS) to sort out components in refractory materials. The bright spots in the picture show the energy generated by the laser to facilitate element mapping.

Credit: ReSoURCE-LSA

Description: Refractory samples after preliminary sorting.
Credit: SINTEF Industry

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