PURE SCRAP

PURITY IMPROVEMENT OF SCRAP METAL

Project information

Start date: 01.01.2023
Duration: 42 months
Type: Innovation Action
Call: HORIZON-CL4-2022-TWIN-TRANSITION-01
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The PURESCRAP project is taking an ambitious, major step toward reducing impurities in post-consumer scrap prior to melting by applying highly efficient sensor stations in conjunction with improved scrap processing. The project thereby provides a contribution to the Strategic Research and Innovation Agenda (SRIA) of the Clean Steel Partnership (CSP) and to the achievement of the European Green Steel goals regarding circular economy as well as to the reduction of CO_2 emissions.

Sensor stations for heavy scrap

The sensor station for heavy scrap consists of three main units combined to accurately determine the average of the chemical composition scrap material. Therefore, both, weight, and chemical composition of the scrap samples are needed. Since LIBS is a point analysis method, it cannot analyse multiple objects simultaneously. It is important to prioritise objects for a statistically accurate average in high-volume material flows.
The three units of the sensor module are:

- Vision unit (RGB-D camera + LiDAR): identifies objects, measures shape, and determines, which objects should be analysed, providing their coordinates.
- Robot unit: positions the LIBS sensor at the correct location and height.
- LIBS unit: performs chemical analysis at predefined positions on the conveyor belt.

The vision unit has to operate quickly enough to guide the robot before the LIBS analysis take place to ensure efficient processing. Alternatively, the system must be designed with enough distance to allow for the necessary processing time. The combined sensor data is then used to predict the average chemical composition of the material. The layout is displayed in Figure 1.

Fig.1: Test line for training and evaluation of sensor systems for heavy scrap

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Sensor stations for shredded scrap

The sensor station for shredded scrap combines multiple sensors, allowing them to enhance each other. The Camera, LiDAR and LIBS are housed together to analyse one section of the belt. The XRF sensor requires a separate housing with material fed on a vibratory feeder and a chute before the sensor. The sensors have been installed at a dedicated test station built purposefully for the PURESCRAP project and will later be moved to the production line of the recycling facility. The layout is displayed in Figure 2.

The sensor system consists of these main units:

- Camera: classifies objects based on visual characteristics, in particular, the model detects copper through its colour and shape characteristics.
- LiDAR unit (composed of both LiDAR and RGB-D Camera): estimates material volume and outlier objects.
- LIBS: conducts chemical analysis with high material throughput and adaptability to object shapes.
- XRF: performs chemical analysis and can be scaled using multiple sensors to cover the full belt width.

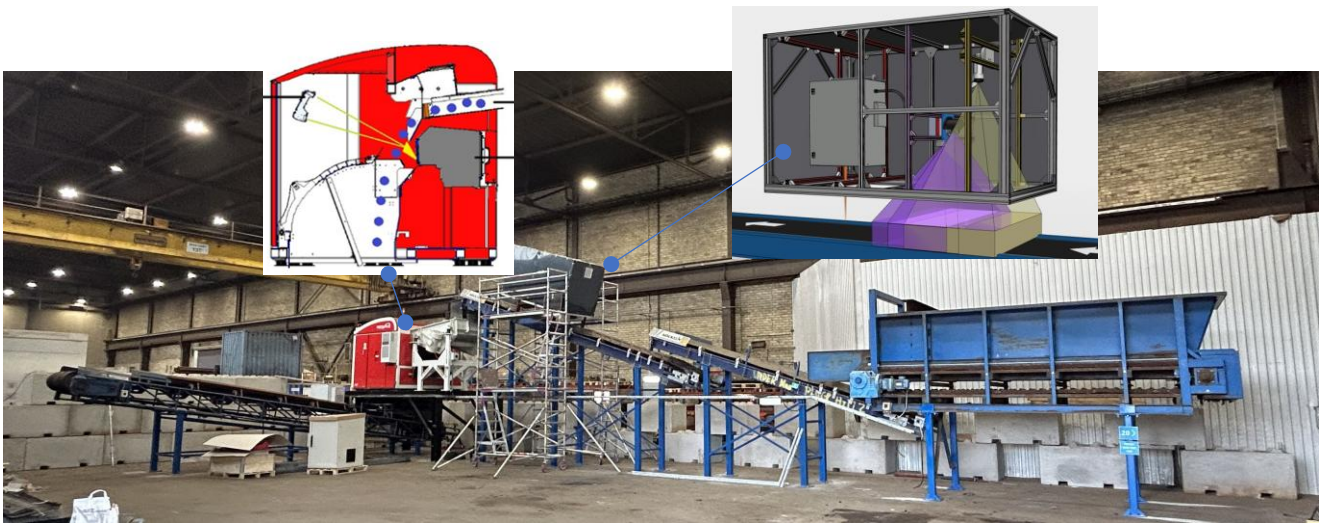

Fig.2: Test line for training and evaluation of sensor systems for shredded scrap

1st PURESCRAP workshop

The PURESCRAP team organised a workshop on April 2nd, 2025. This event focused on the implementation of sensors for scrap analysis, bringing together experts, industry leaders, and researchers to share their insights. The aim of the workshop is to share experiences of practical installation and use of sensors in industrial environments – scrap processors and metals producers. Together we want to overcome challenges and avoid repeating mistakes.

Fig.3: Participants joining the workshop in presence

The presentations generated engaging discussions and offered meaningful perspectives on both the opportunities and challenges surrounding these developments. The exchange of knowledge highlighted the value of collaboration in advancing innovation. We thank all participants for their contributions and look forward to ongoing exchange in the future. To download the full presentations, click here.

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