Improved analysis of postconsumer scrap to further push a circular steel industry



voestalpine Stahl

ESTEP 2024 Annual Event

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European Steel Technology Platform

20 years together

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FOR GREEN STEEL 3rd INTERNATIONAL CONFERENCE meets A CIRCULAR ECONOMY DRIVEN BY THE EUROPEAN STEEL

SCRAP QUALITY A challenge for future steel production



- Crude steel demand will be 30% higher in 2050 than it is today
 - Contribution of scrap in total steel charge will likely grow to 40% in 2050 from currently ~30%
 - 79.3 Mt of scrap used in EU (2022)
- Increasing share of post-consumer scrap will not allow 100% recycling for all highquality steel grades





Sources: Mission Possible Partnership, Net-zero steel sector transition strategy (2021) Worldsteel Association, Scrap use in the steel industry, fact sheet, 2021

SCRAP TRADING

- Metallic tramp elements (e.g., Cu, Sn, Cr, Ni, Mo) prevent reuse of post-consumer scrap for some steel grades
- Surplus of low-quality scrap within the EU generates large scrap exports (EU as worldwide largest scrap exporter)
- 17.6 Mt scrap exported from EU-2027 in 2022 (19.2 Mt in 2023)
 - NED as main scrap exporter (3.9 Mt in 2022)
 - TUR and EGY as main buyers
- Higher quality scrap is imported into the EU to be used for steelmaking
 - 3.9 Mt in 2022

Co-funded by he European Union

Motivation for R&D&I → Enable increased use of post-consumer scrap in steel industry





PURESCRAP PROJECT

Partners and main roles







PURESCRAP APPROACH

Sensors for size, volume, and composition





- Sensor stations to analyse heavy and shredded scrap
- Heavy scrap: Vision (camera + LiDAR) Robot unit (for LIBS positioning) LIBS ICT network
- Shredded scrap: Camera LiDAR + RGB-D camera LIBS XRF ICT network

PURESCRAP CONCEPT

Batchwise analyses of scrap













SENSORS COMBINED WITH SCRAP ANALYSIS

RECYCLING

System	Status
Feeder and belt	✓ Ready
Belt control system (PLC)	 ✓ Electrical connections □ Interface with server (belt status)
Server	 ✓ Installed and ready (waiting for PLC connection)
XRF	✓ Machine installed
LIBS	 ✓ Mounted and connected □ Finetuning needed
Camera	 ✓ Mounted and connected □ Training for image analysis
3D	 ✓ Mounted and connected □ Training for volumetric analysis

Test station for shredded scrap analysis



The first batch of complex Fe scrap passed through the system





Testline for training and evaluation of sensor systems for shredded scrap



SENSORS COMBINED WITH SCRAP ANALYSIS

Sensor station for heavy scrap analysis

All devices and initial test activities are started.

Material handling: feeder, conveyor

Sensors: 3D, LIBS (on robot)





Planned real sensor station arrangement for heavy scrap

Arrangement of 3D sensor and LIBS sensor for heavy scrap analysis LIBS-robot is guided by the 3D sensor





SWERIM

SENSORS COMBINED WITH SCRAP ANALYSIS

Sensor station for heavy scrap analysis



Analysis station for heavy scrap ongoing mounting of parts



Cleaning effect on rusted samples



Calibration for Mo, 180 ppm absolute error



OUTLOOK ON SCRAP USE FOR STEELMAKING

Melting of the sorted scrap and steel quality analysis

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Induction Furnace (5t capacity)



Ladle Treatment (Ladle Furnace + Vacuum Degassing)









Caster

(Vertical

continuous line)

INTECO

Round casted material (Ø 230 mm) or ingots (270x360 mm)

Peripherals



Ladle and tundish management and firing, dust separation





- Environmental and economic impact assessment for reuse of post-consumer scrap
- Definition of final goals and scope as 1st step (discussions currently ongoing)
 - Functional unit: production of 1 ton crude steel
 - System boundaries: cradle-to-gate





metallurgical competence center



Thank you! Questions?

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