GEAR-UP

EFFRA MANUFACTURING DAYS 2026

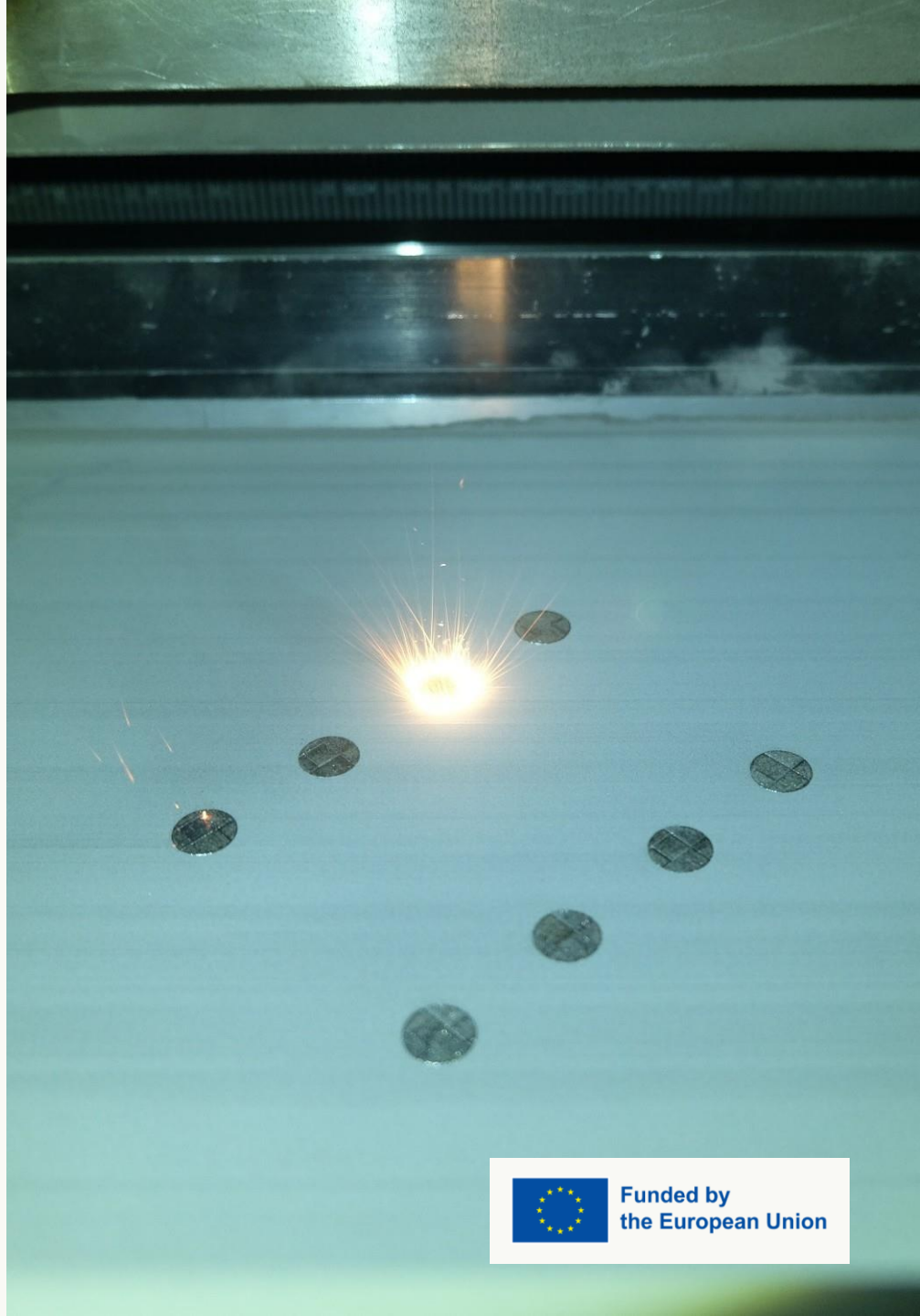
Layer by Layer Towards a ĠØÑÑŌ MŌDŇ GÒỲÒÞMÕ Industry

Insights from GEAR-UP

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CONSORTIUM

COLFEED4Print · eit Manufacturing · FLOWPHYS · aerobase · CelluCircle Cellulose for Circularity · 3D Production · Welding Alloys · Fraunhofer · Aker Solutions · TECHNOVATIVE SOLUTIONS · eurecat Centre Tecnològic de Catalunya · SINTEF · DigiProd Pass



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THE PROJECT

What is GEAR-UP?

GEAR-UP enables secondary and recycled materials in additive manufacturing, with digital tools that handle material variability.

CHALLENGE	GEAR-UP RESPONSE
Energy-intensive extraction of virgin materials	Secondary and recycled feedstock in AM workflows
Subtractive manufacturing: high material and energy use	Near-net-shape AM: PBF-LB, DED-LB and ME-FRP
Heavy, over-dimensioned components	Topology optimisation and lightweighting
Fragmented data, slow uptake of AI and LCA, low traceability	Ontologies, digital twins, AI-powered LCA and Digital Product Passports
Skills shortages	Training and reskilling programme

Why additive manufacturing?

Recycled metal carries trace elements that vary from batch to batch. AM is flexible: process parameters and part design can be tuned to the components we have, instead of rejecting it.

USE CASES

Today's focus: metal



Robot gripper
PBF-LB



Pelton bucket
DED-LB

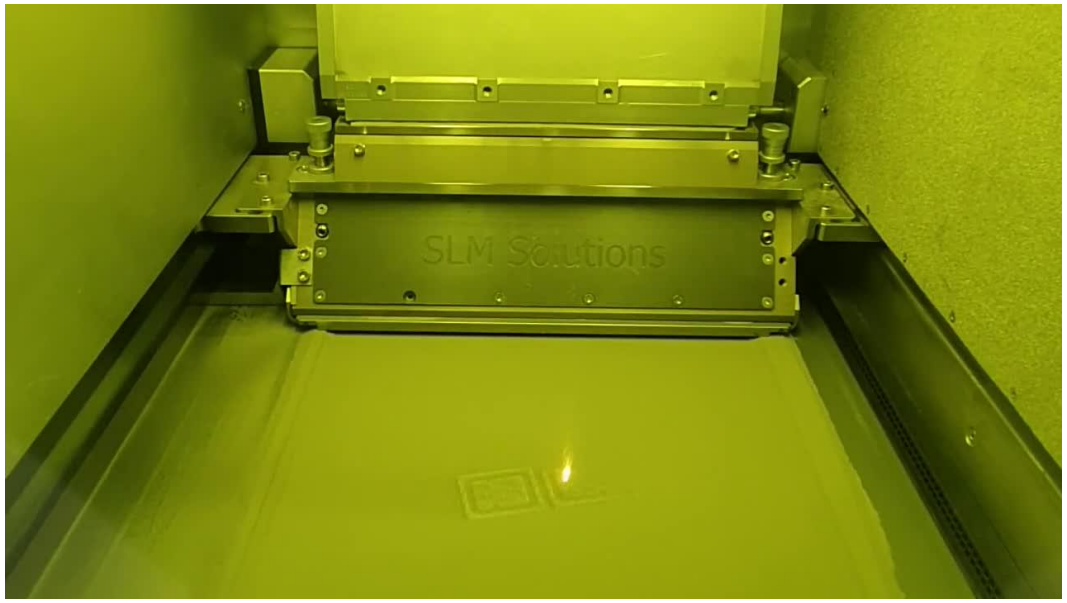


Drive sprocket
ME-FRP

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Laser-based metal AM in GEAR-UP

PBF-LB Laser powder bed fusion



- Laser melts thin powder layers, one layer at a time
- Fine detail and complex shapes
- Use case 1: robot gripper, AlSi10Mg

DED-LB Laser directed energy deposition

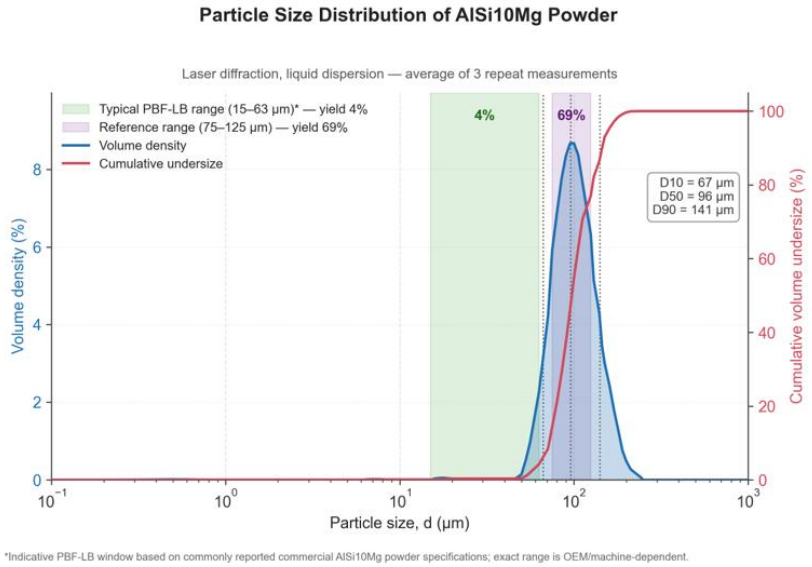


- Laser melts wire into a moving melt pool
- Large parts and repair in our hybrid cell
- Use case 2: Pelton bucket, 13-4 martensitic stainless steel

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Use case 1 – Robot gripper

Why powder size matters (AlSi10Mg)



4 %

in a typical PBF-LB size window (15–63 µm)

69 %

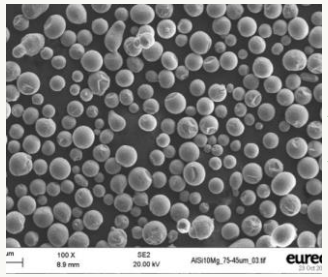
in 75–125 µm, the size we print at SINTEF

1 Atomise



Eurecat: centrifugal atomisation of AlSi10Mg with trace elements

2 Characterise



Particle size and morphology of each batch

3 Print



45–75 µm → 3D Production
75–125 µm → SINTEF

4 Test



High density in all screening samples → tensile specimens

The research gap

Centrifugal atomisation mainly produces powder coarser than commercial PBF-LB grades. Printing 75–125 µm powder is unconventional, so we need to research it to make this route viable with trace elements.

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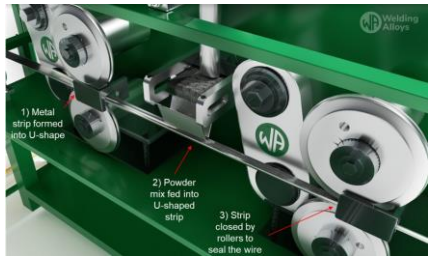
Use case 2 – Pelton bucket

Trace elements build up in recycled steel in Aker Solutions' production line. **Vanadium (V) and tungsten (W)** were higher than usual. What do they do to a DED-LB part?

23 V

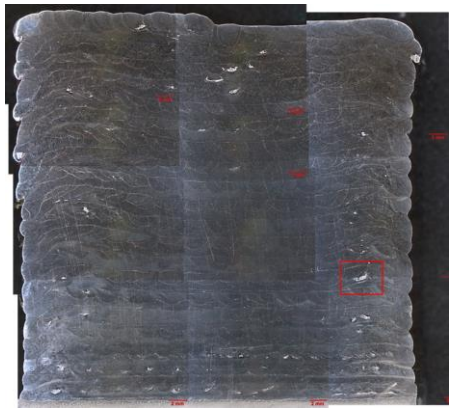
74 W

1 Replicate



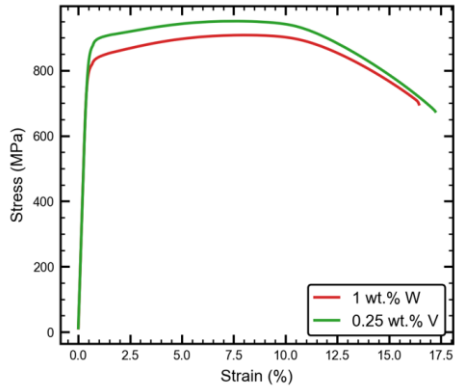
Welding Alloys made metal-cored wire that replicates the trace-element levels.

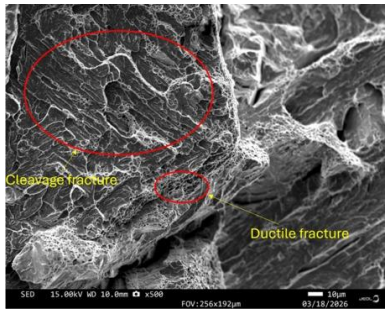
2 Build



DED-LB parameter optimisation to remove initial lack of fusion.

3 Test





Strength ▲ **Toughness ▼**

Initial results: higher strength, lower toughness and cleavage fracture.

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Closing the loop

1 · OPTIMISE

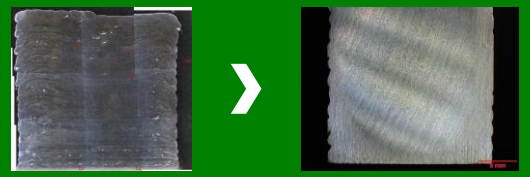
Trial-and-error parameter optimization and characterization

Screening builds find a working parameter window.

PBF-LB · screening coupons



DED-LB · before → after



2 · MODEL & DESIGN

Digital twins & material models

Calibrated with results from optimized parameter samples (tensile, fatigue etc…)

Topology optimisation

Fatigue constraints from the same data give lighter parts

3 · PRODUCE & DOCUMENT

Production data → AI

Use data gathered now to train AI models

Component Characterization → DPP

Test results document compliance in an ontology-driven passport



Topology optimisation with fatigue constraints

The initial results are only the start. Every build and production batch produces data that makes the next build leaner, lighter and traceable.

Closing the loop: feeding models to work “autonomously”

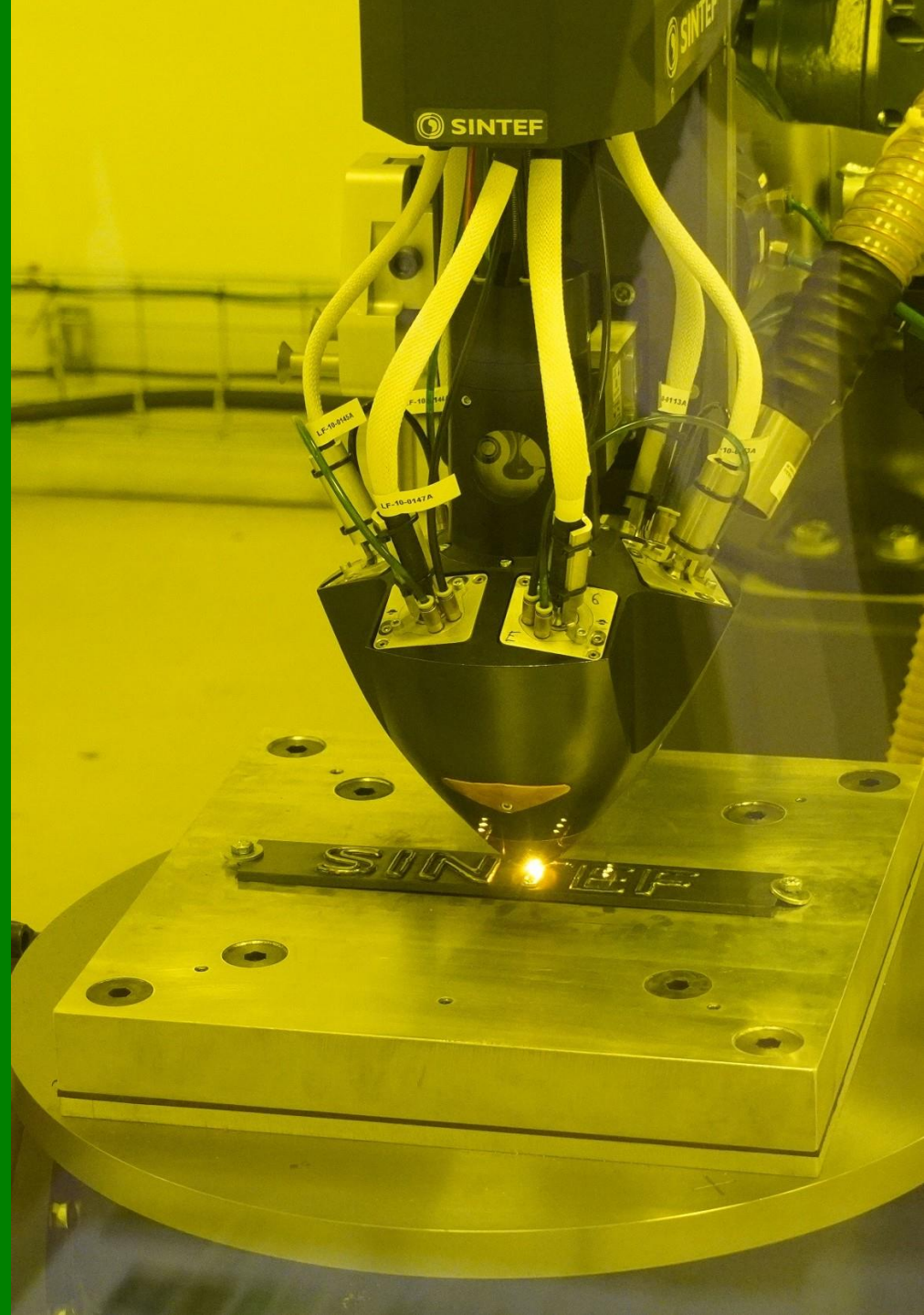
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GEAR-UP

Thank you

Layer by layer towards a green and digital industry

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