

**SWEDISH MANUFACTURING R&D CLUSTER CONFERENCE 2024**

# **Re-manufacturing of cast components by compound casting**

**Lennart Elmquist, RISE**



# Introduction

- Component casting at RISE
- Re-manufacturing and compound casting
- Circular material flows and casting
- Examples from different projects with the same goal; produce a "perfect" bonding by compound casting.

Same materials or a combination of different materials where the purpose is re-manufacturing, locally optimized properties or to create functional areas.



Photo: Patrik Svedberg

*The right properties in the right place!*



# Remanufacturing

Re-manufacturing – an important tool for a circular economy

*“Remanufacturing is about components or products being processed to new condition with the same or improved performance as a newly manufactured product, often with the same warranty as in case of new manufacture. The process usually includes the number of sub-processes, e.g. inspection, disassembly, cleaning, machining, assembly and testing.”*

(Source: <https://www.ri.se/en/what-we-do/expertises/remanufacturing>)



**Other forms of product recovery:**

- Reuse
- Repair
- Refurbishing/Reconditioning
- Recycling



# Compound casting

- A process where a single component is manufactured from two metallic materials through casting.
- By controlling the process appropriately, solid-liquid bimetallic compounds can be produced.
- This technique can reduce the number of joining processes, and the specific properties of each metal alloy can be utilized.
- For example, it's useful in applications where light weight and high strength are required.



The challenge is to create a transition between the materials that is good enough for the application in question



# Åsapåg

## Re-manufacturing of cast components through dual casting

### Project background

- Feasibility study 2019-2020
- Project time full project 2020-2023
- Total budget: 6,2 MSEK
- Participating foundries and component owners:  
Combi wear parts, Sandvik SRP, and Österby gjuteri
- Financed by Vinnova



The project idea is to develop and verify a circular model for remanufacturing of complex cast components by compound casting of new functional layers.

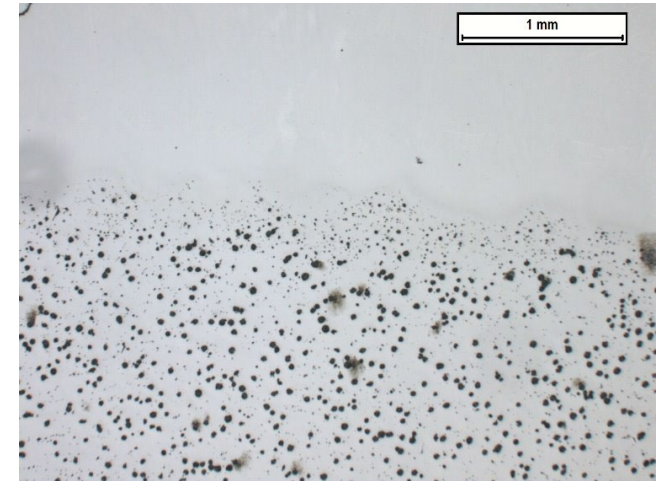


# Åsapåg

## Feasibility study re-manufacturing

**Concept idea:**  
Casting a base component in simpler materials and/or in complex geometry and casting on an advanced alloy in a second step

- Through smart innovative design, castings can be remanufactured in several cycles
- The business model evolves from selling cast components to providing service
- Project lasted for eight months, from 2019-06-06 until 2020-02-06



White iron and ductile iron

The aim is to better maintain the value added and enable complex multimaterial products that can circulate with small resource losses.

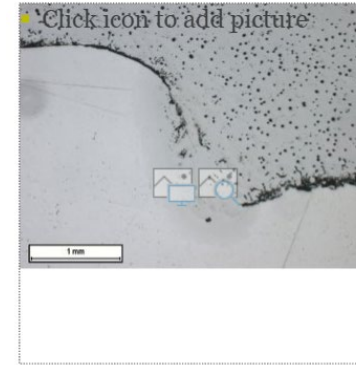


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H Rostfritt mot segjärn



D Vitjärn mot segjärn





# Åsapåg

## Re-manufacturing of cast components through dual casting

- Circular material flows have long been an integral part for the Swedish steel foundries, but a large part of the value added is lost during remelting and downgrading of the steel through contaminants and losses in the scrap management and recycling process.



- A circular model for remanufactured castings that to a greater extent retains the value added has the potential to radically shift the focus of the foundry industry.



# Åsapåg

## Examples of results

- Technical tests
- Workshops about sustainability
- Future concept



### Aim of the workshop

Based on a Sustainability perspective, develop concrete proposals and points to work on (gross list)

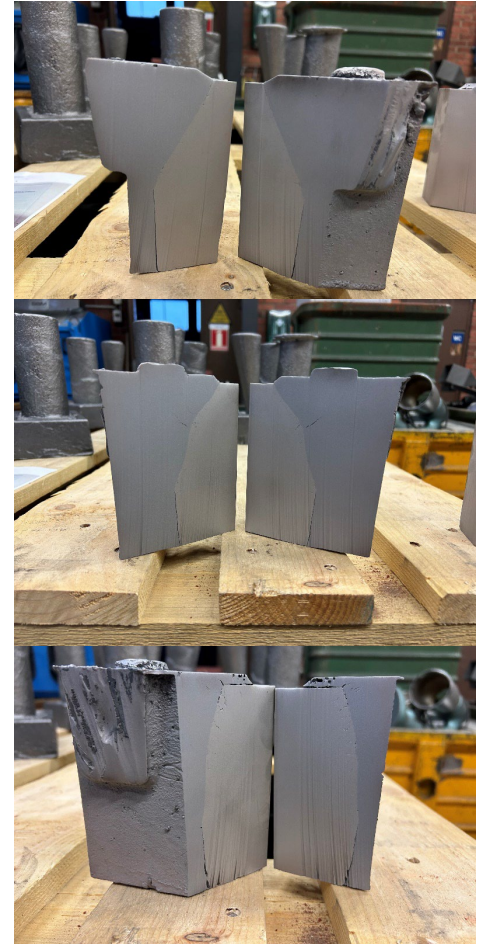
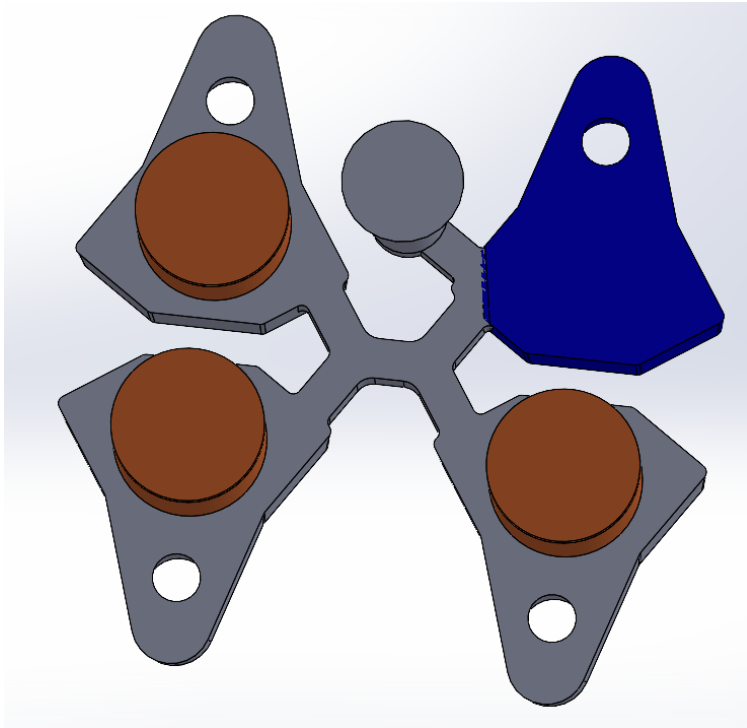
- The company then prioritizes which activities that are reasonable to start with
- Presented to the staff
- The goal is that about 4-5 activities will be started fairly immediately
- Follow-up in about 6 months to evaluate the results

After that, additional items on the gross list can become concrete activities



# Åsapåg

## Demonstrator 1

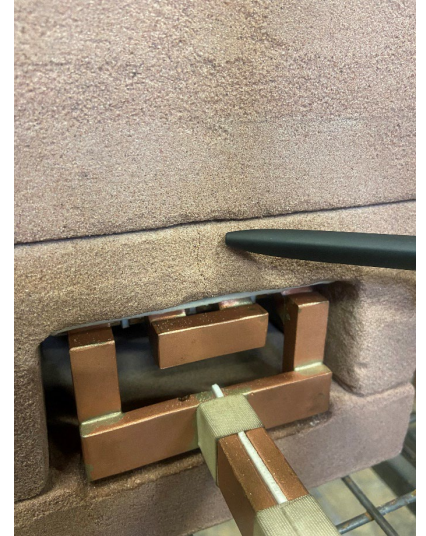
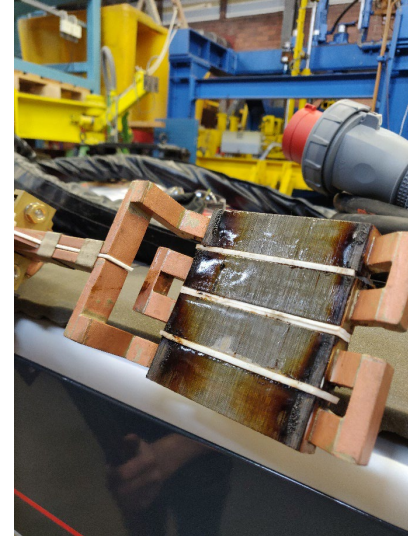
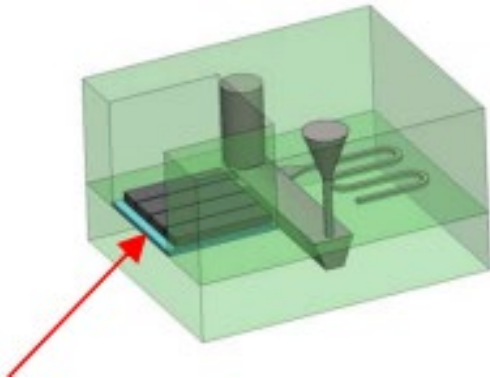




# Induction assisting casting

Three completed projects (Matartek, Impflow and Åsapåg) and one ongoing (REMI)

- Optimized feeding
- Compound casting
- Thin-walled sections

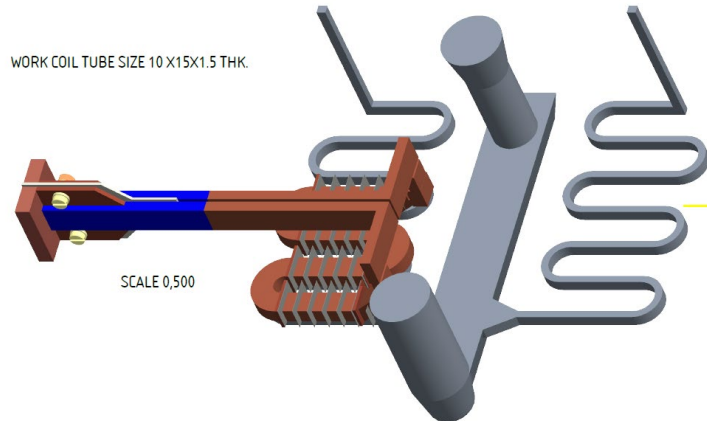




# REMI

## REsurseffektiv Matarlös gjutning med Induktionsvärmning

- Assists mould filling
- Control the zone for compound casting
- Optimize the microstructure



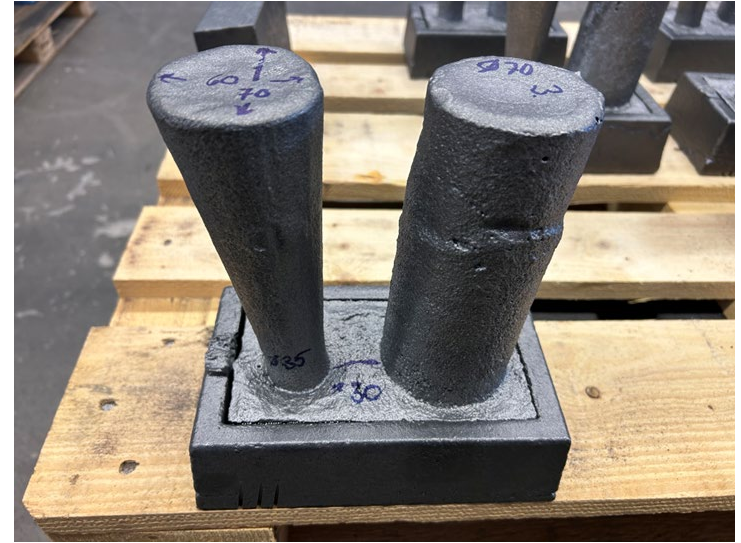
Channel to the right is with induction coil



# Åsapåg

## Demonstrator 2

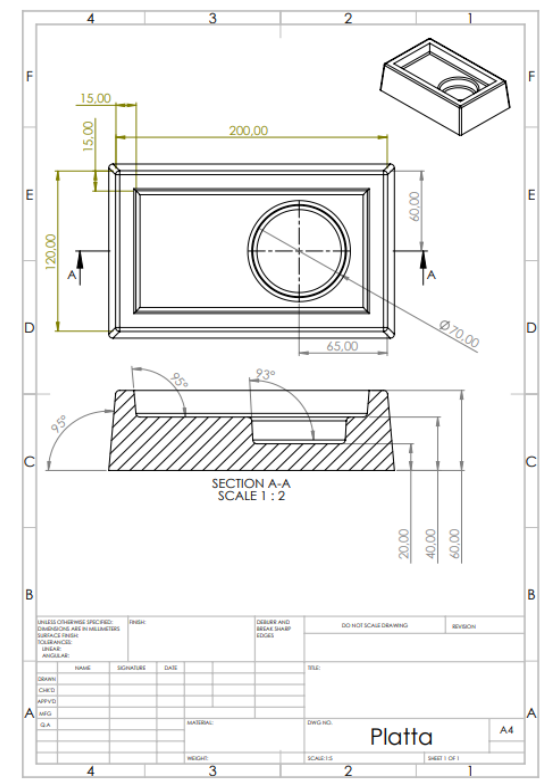
- Comparison with and without induction
  - No machined surface
  - Milled surface only in the bottom
  - Milled surfaces both in the bottom and on the edge





# Åsapåg

## Demonstrator 2

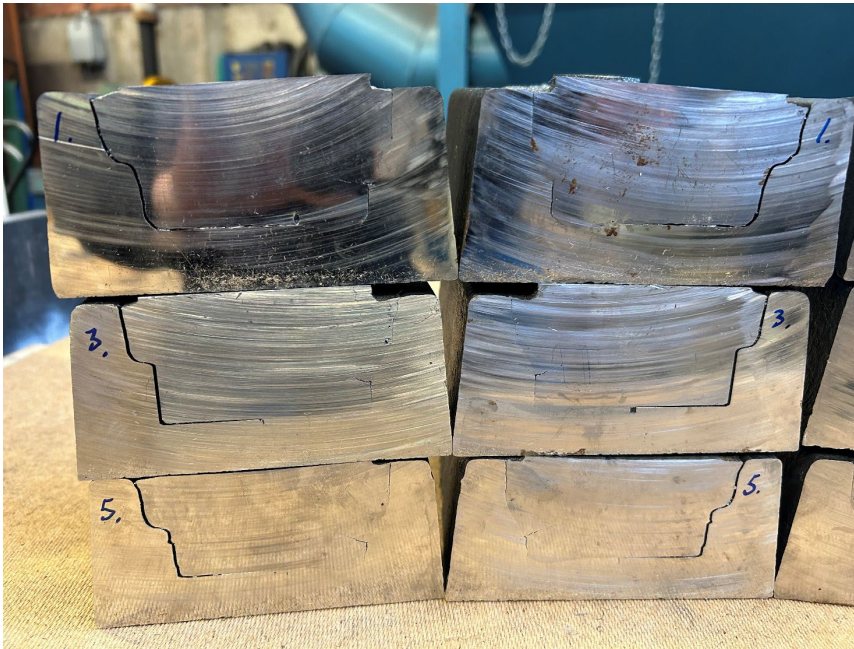




# Åsapåg

## Demonstrator 2

No. 1 and 2: No machined surface  
No. 3 and 4: Milled surfaces both in the bottom and on the edge  
No. 5 and 6: Milled surface only in the bottom



References (without induction heating)

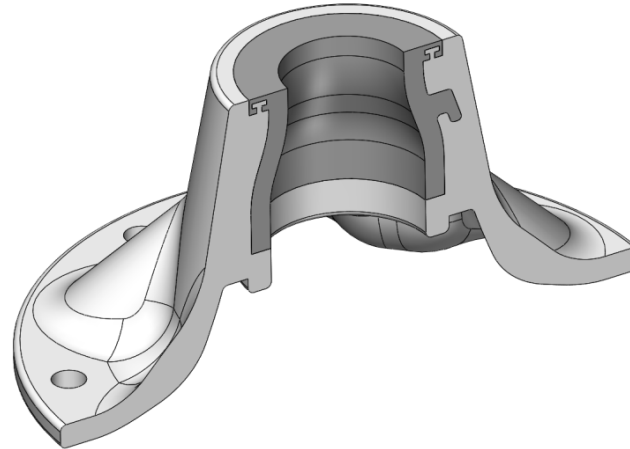
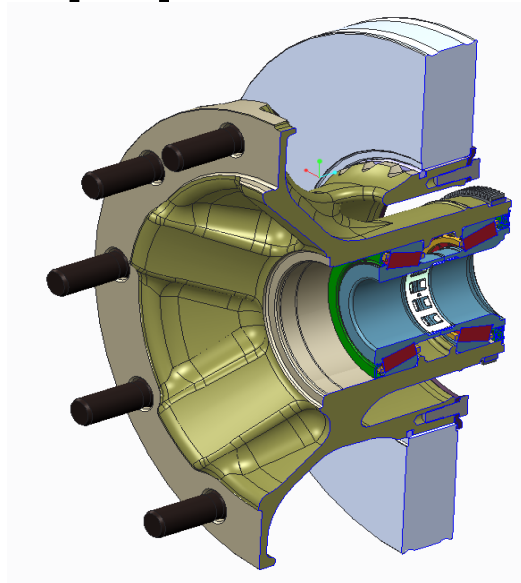


With induction heating



# CompLätt

**Compound casting for lightweight solutions with optimized properties**



*The right properties in the right place!*



# Ongoing and planned projects

## Ongoing

- REMI is a feasibility study where induction heating is used to investigate the possibility to increase fluidity and e.g. produce thin-walled castings. Ends in June

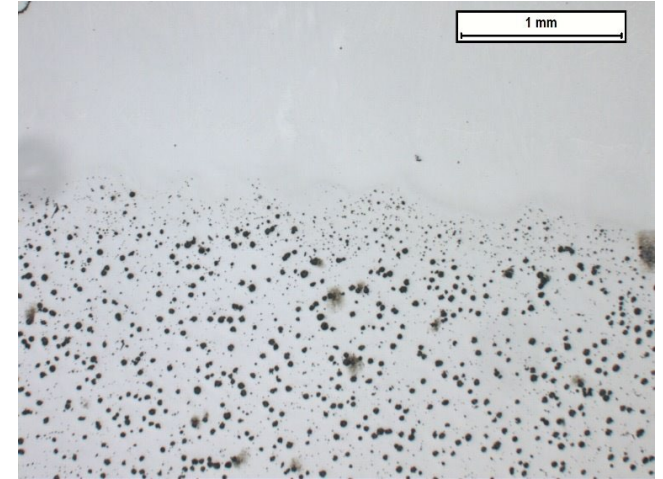
## Planned

- The plan is to apply for a larger project to continue the work done in REMI
- Discussions are ongoing for a continued work with CompLätt
- Variable scrap yard is also on the planning stage



# Summary

- Re-manufacturing is an important part of circular material flows
- Combination of different materials using compound casting is a way to obtain optimized properties
- The challenge is the transition between the different materials, especially if a perfect metallurgical bonding is needed
- Additional heat by induction coil is an alternative
- However, more R&D is needed

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