

Master Alloys - A way to increase performance in PM steel

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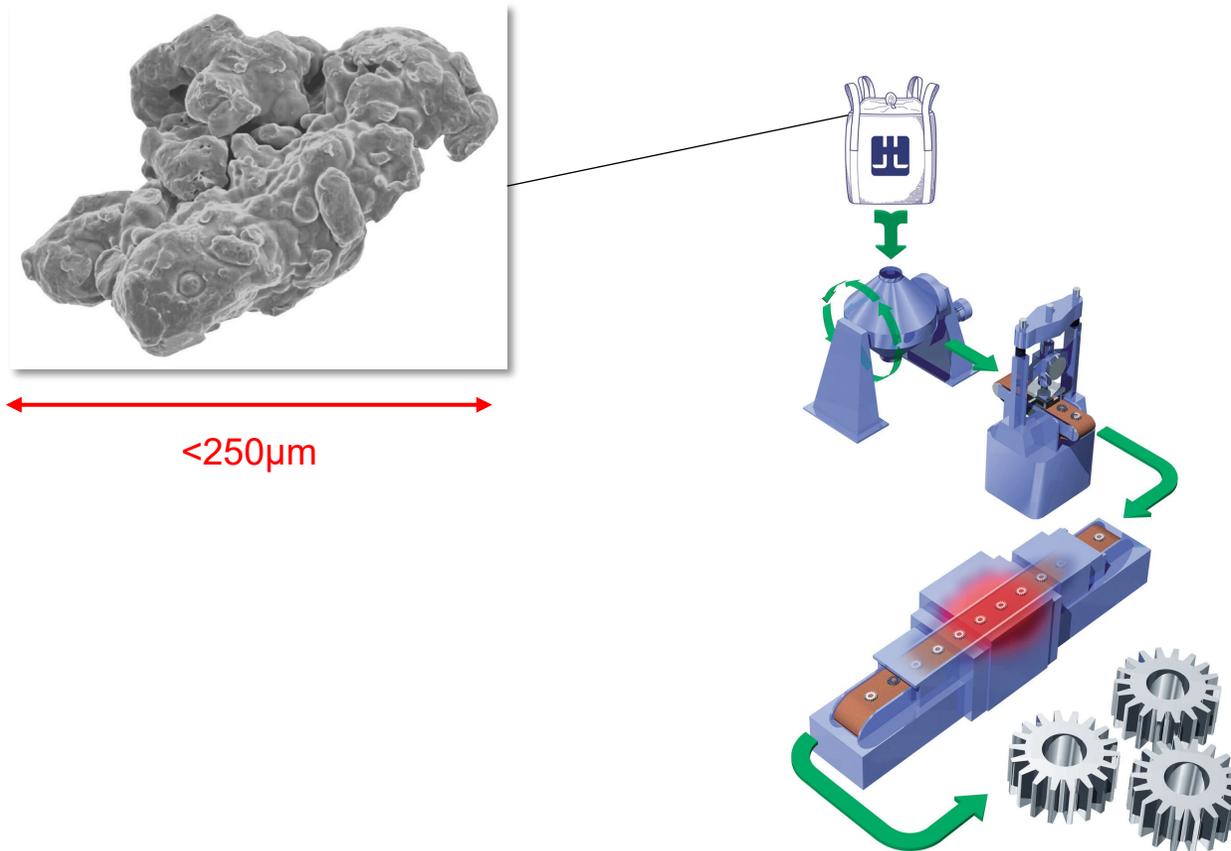


The "extreme" collaboration



Wallenberg Initiative
Materials Science
for Sustainability

The PM process route



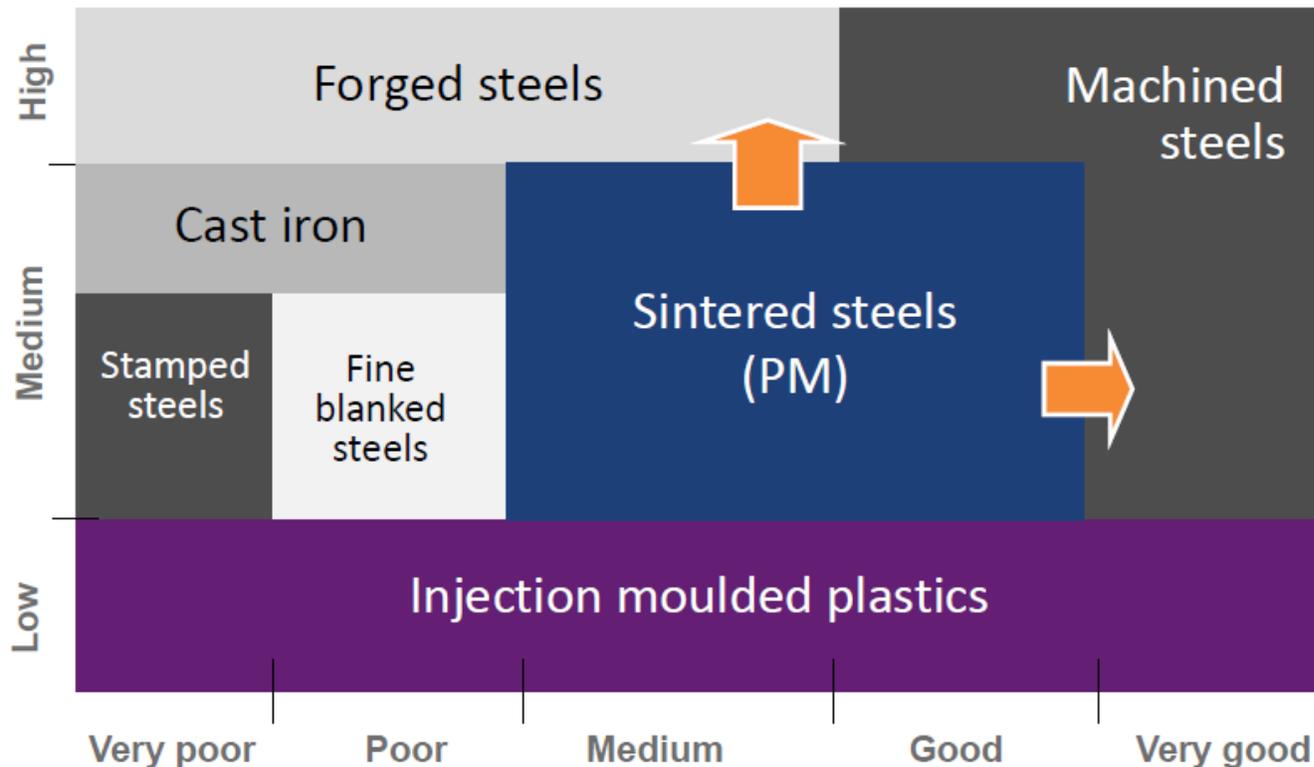
Why PM?

- Uses recycled raw material
- Efficient use of resources
- Simplifies recycling of end products
- Broad range of materials and compositions/unique properties
- Design freedom
- Robust and cost-efficient process
- Close dimensional tolerances



The PM playing field

Strength



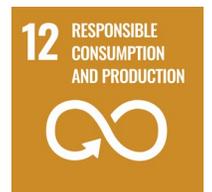
- » To improve performance
 - » higher density
 - » microstructural control through
 - » Chemistry
 - » Process optimization

What are we trying to do

- » To enhance performance, alloying elements such as Ni or Cu are often introduced to powder mixes
 - Health hazardous
 - Recyclability
 - Availability
 - High environmental impact

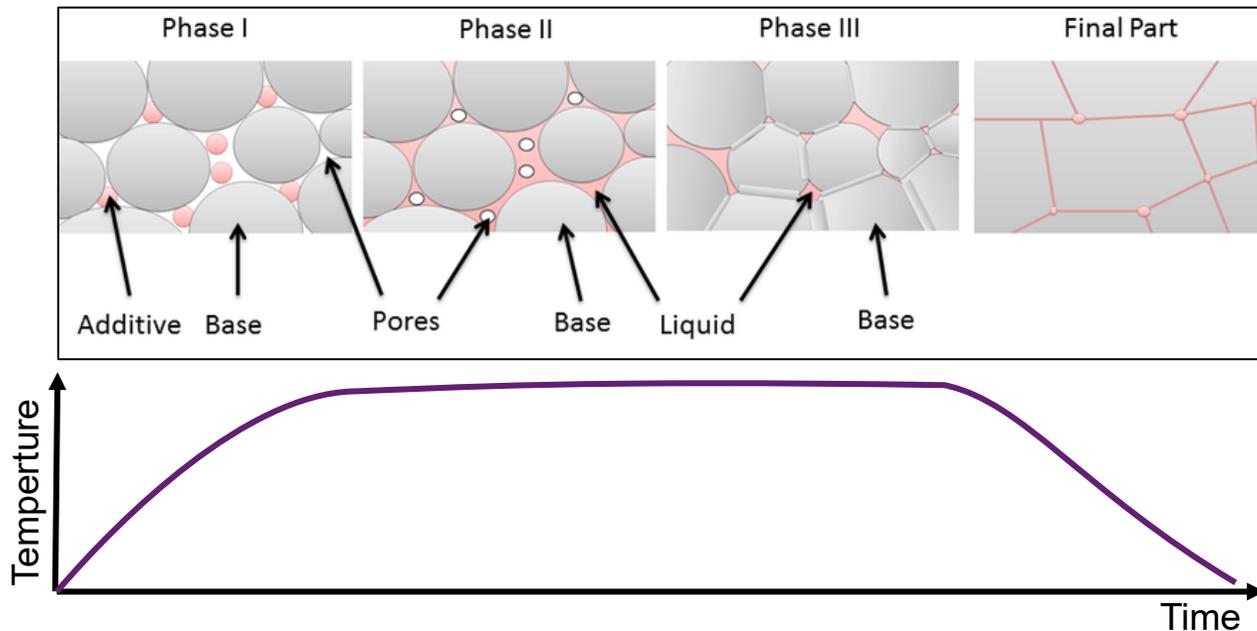
- » Introduce Mn-Cr-Si instead
 - + Easily available
 - + Lower environmental impact
 - + High hardenability – performance

Elements	CO2 footprint
Mn	20%
Si	32%
Cr	35%
Ni	100%



The Master Alloy (MA) route

Intermediate alloys with specific composition which is mixed with a base powder in small amounts



Alloying takes place during sintering through liquid phase formation, diffusion and homogenisation

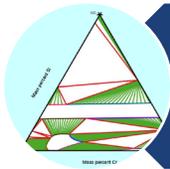
Advantages

- » Maintain good compressibility
- » Densification

Challenges

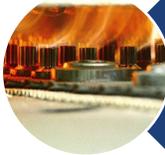
- » Good control of the sintering atmosphere is required
- » Residual porosity after MA melting
- » Inhomogeneous structure

How are we going to do it?



Alloy design

- » Simulation tools
- » MA production in pilot scale and characterization



Process optimization

- » Sintering (High Temperature)
- » Heat treatment



Performance evaluation

- » Mechanical Testing
- » Characterization of sintered and heat treated components



LCA

- » Involve LCA analysis for every stage of the process

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**How can we
inspire you?**

