



Multi-material joining process using cold spray and laser texturing

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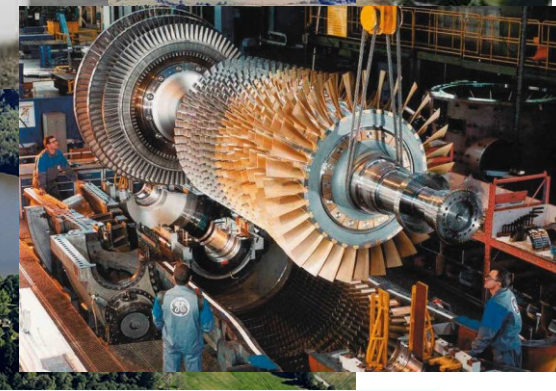
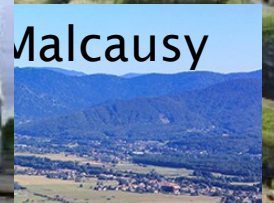
Belfort



Belfort's lion from Bartholdy



Vauban citadel



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Summary

1. New joining process
2. Laser texturing
3. Assembly configuration
4. Conclusion

1. Surface texturing for multi material assembly

Laser texturing

Cold Spray

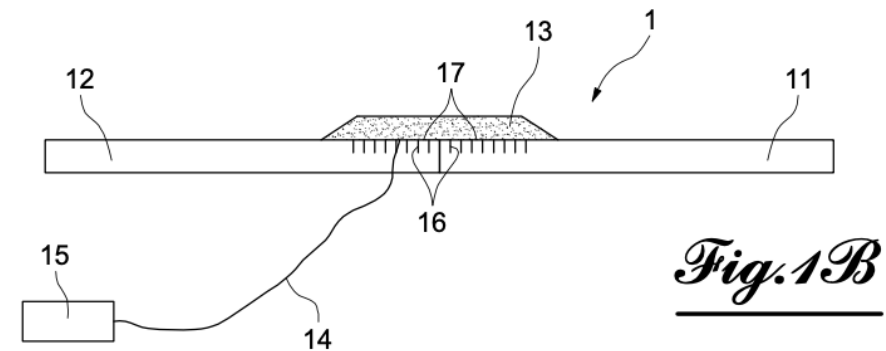
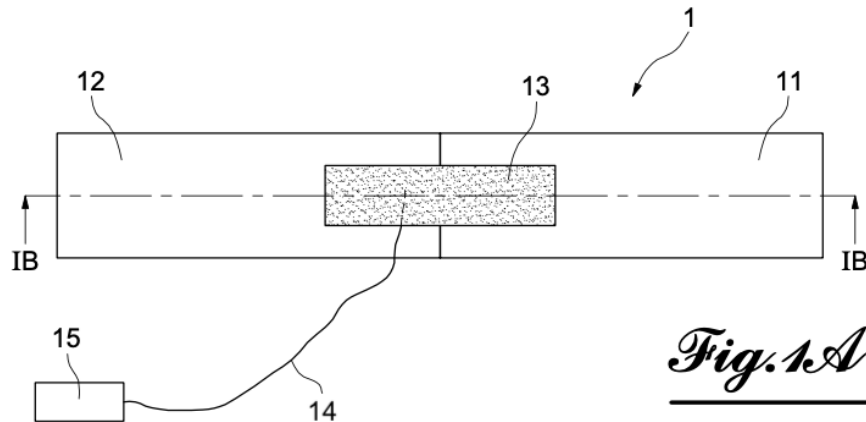
New joining process patented:
LISI μ -MACH AP[®]
(micro Mechanical Anchoring Cold Hybrid Assembly Process)

→ **Multi-material assembly steel/aluminium alloy**

A. KUSURAN, PhD Thesis University of Technology of Belfort-Montbéliard, 2023

1. LISI μ -MACH AP

LISI Automotive: manufacturer of safety components & elements

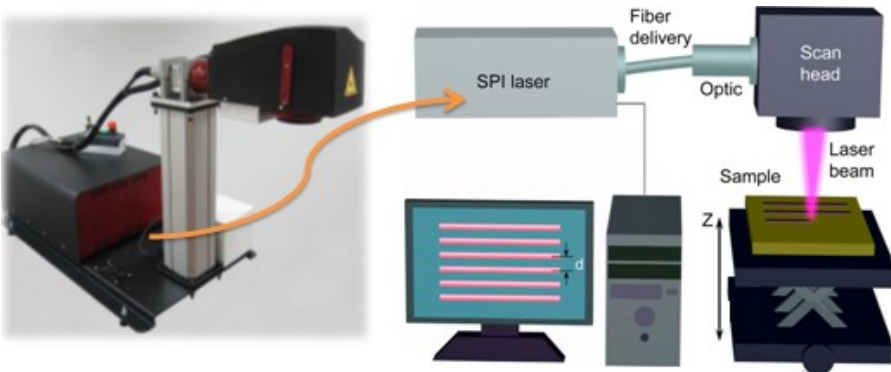
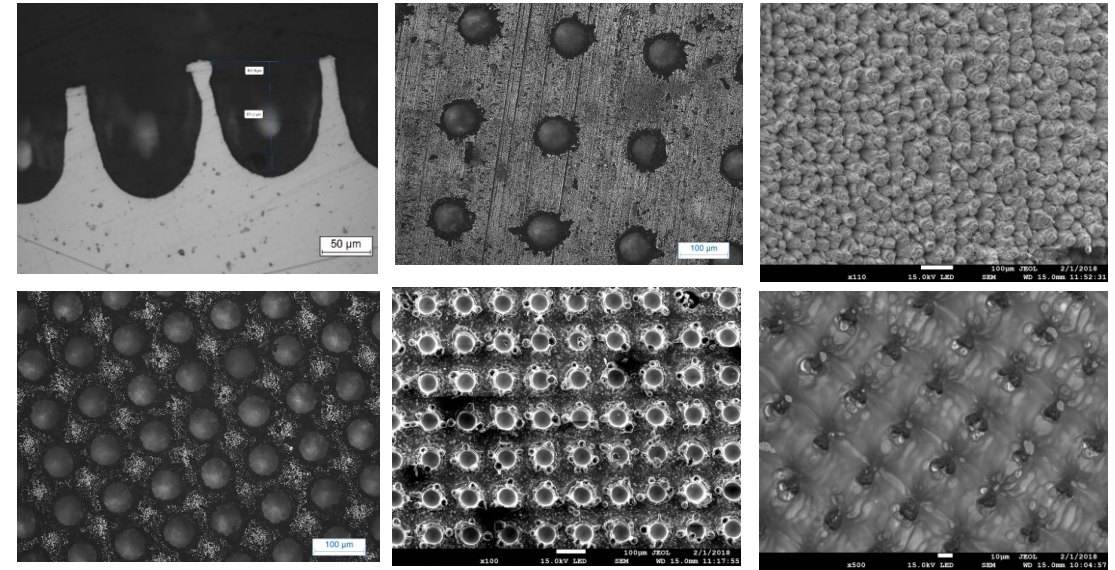
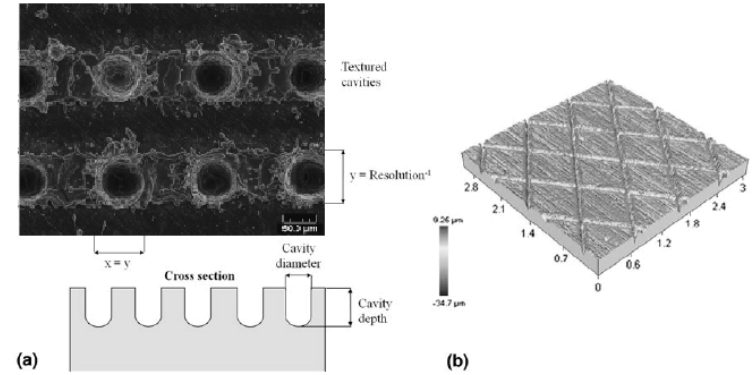


The aim is to join two plates in two different materials using cold spray deposition.

- monitor the evolution of the assembly over time (strain gauge or sensor)
- predict possible damage

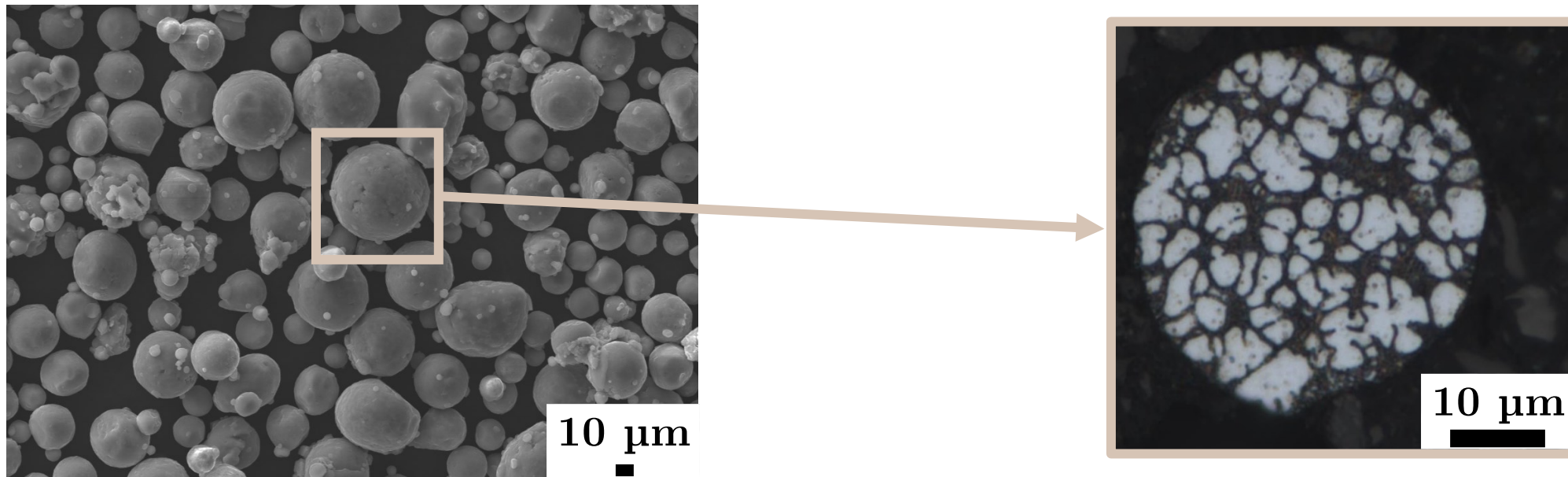
2. Laser texturing

- different pattern morphologies
 - holes, lines, etc.
 - depth, diameter, angle
- \pm dense spotted surfaces

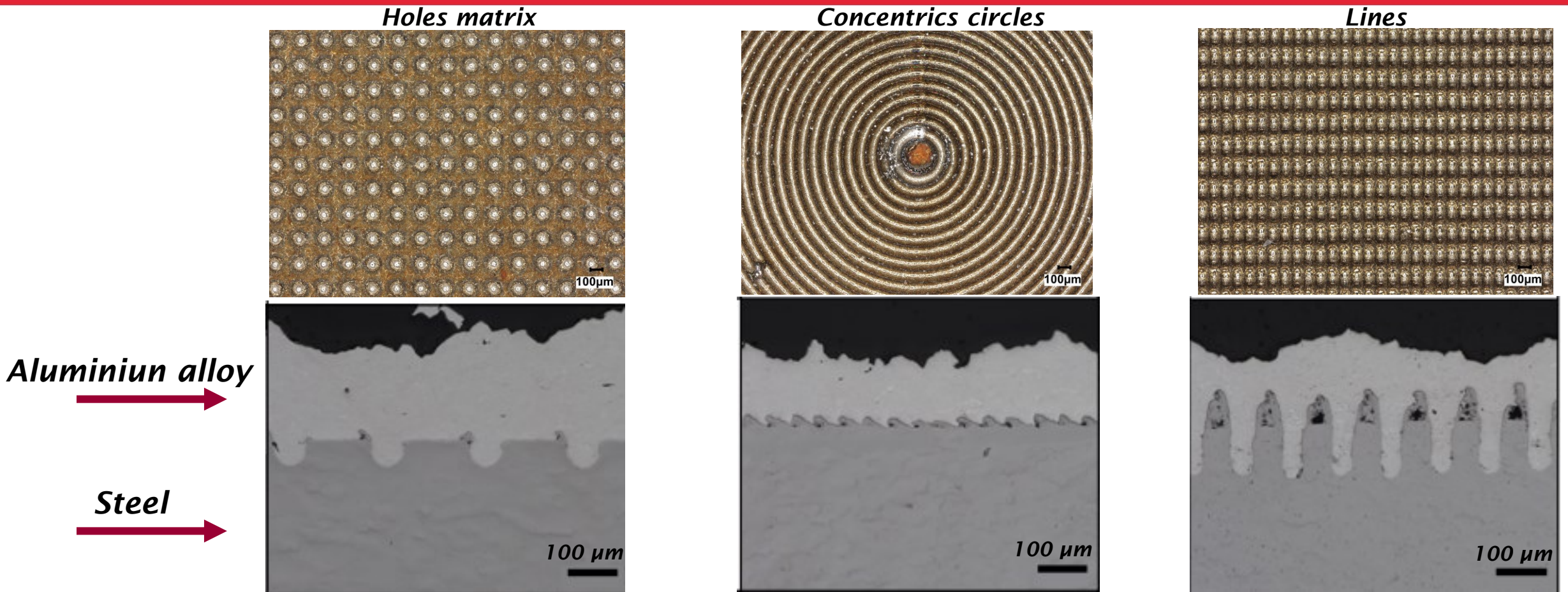


A. LAMRAOUI, Ph.D. thesis, University of Technology of Belfort-Montbéliard, 2011
 R. KROMER, PhD thesis University of Technology of Belfort-Montbéliard, 2016
 L. DESPRES, PhD thesis University of Technology of Belfort-Montbéliard, 2020
 A. KUSURAN, PhD thesis University of Technology of Belfort-Montbéliard, 2023

2. Powder AlSi10Mg



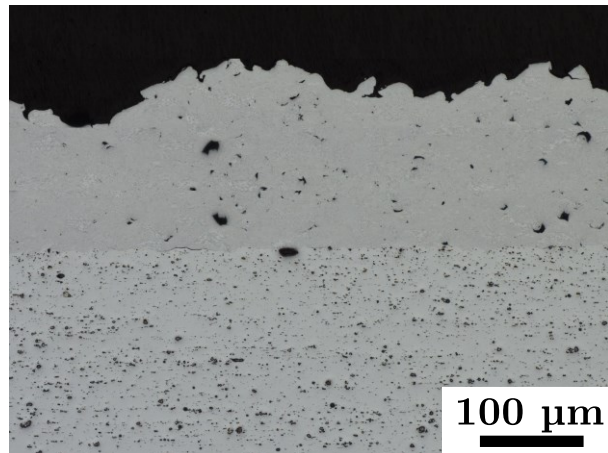
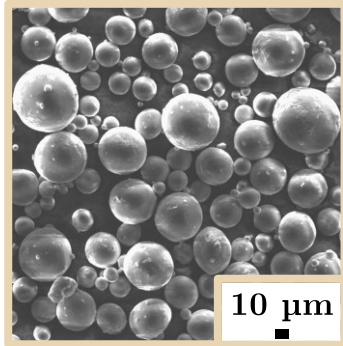
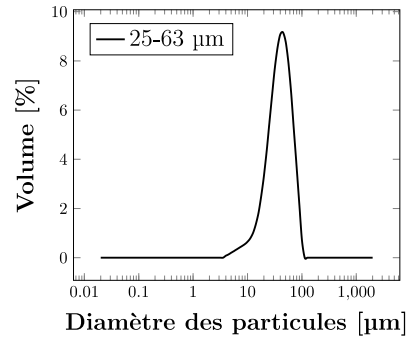
2. Surface texturing for multi material assembly



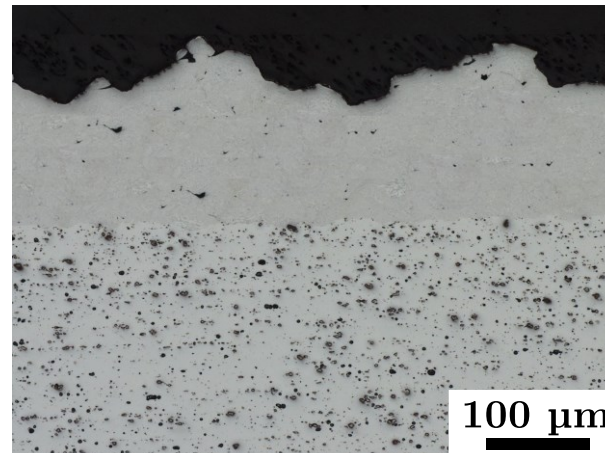
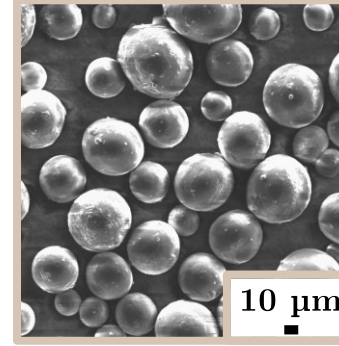
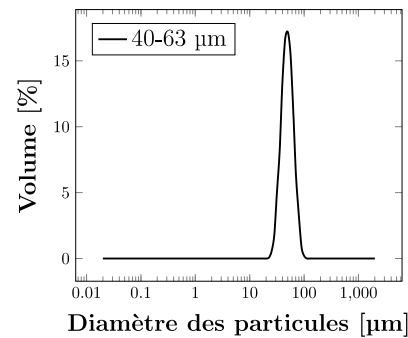
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2. Particle size

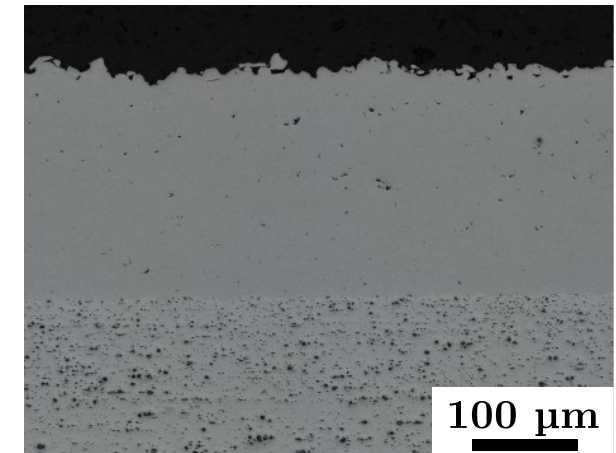
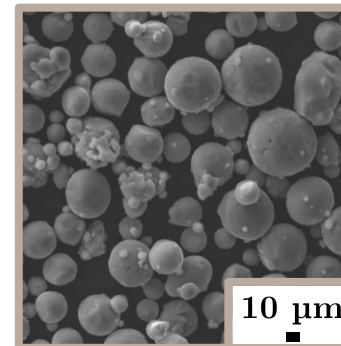
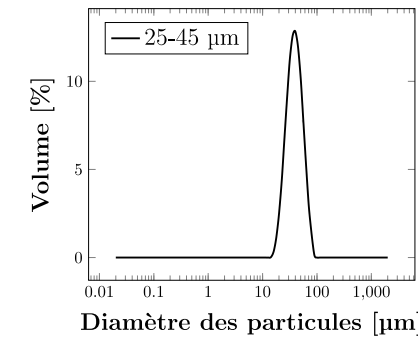
25-63 μm



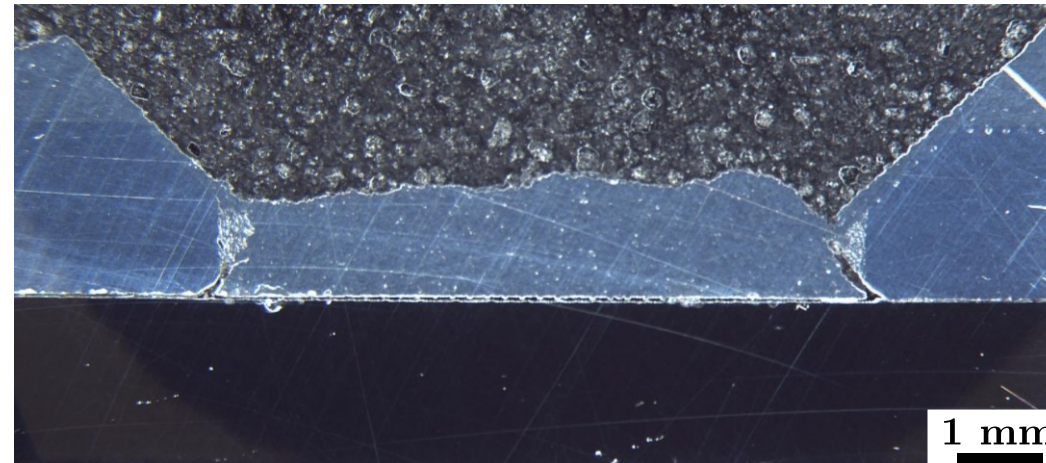
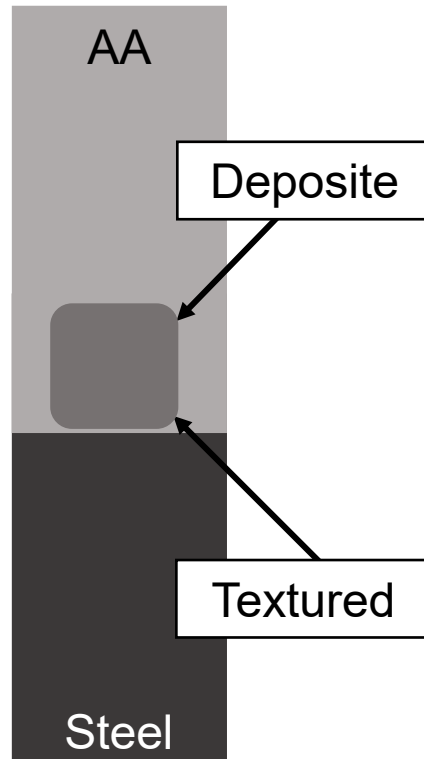
40-63 μm



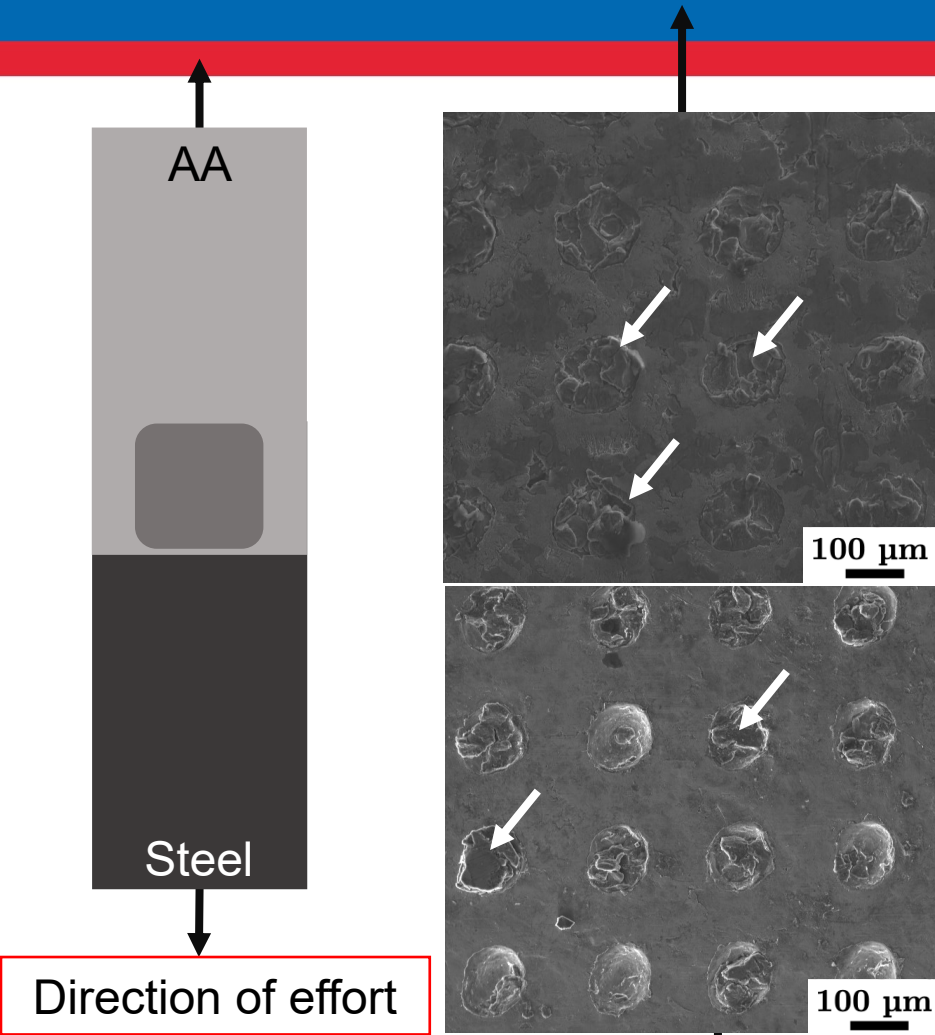
25-45 μm



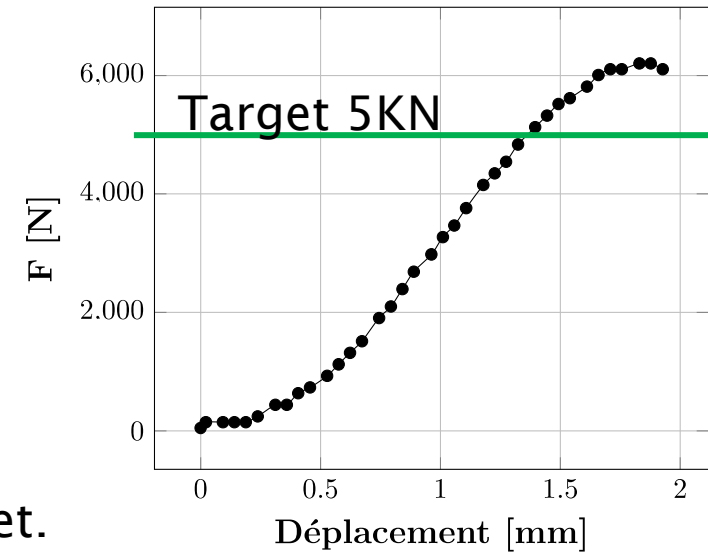
3. Assembly configuration



3. Surface texturing for multi material assembly



shearing at the anchor feet.



3. Surface texturing for multi material assembly

Diverse assembly configurations

According to sollicitations

In L

Steel



Tension

Butt joint with double chamfer

Steel



Tension

Butt joint with chamfer

Steel



Tension

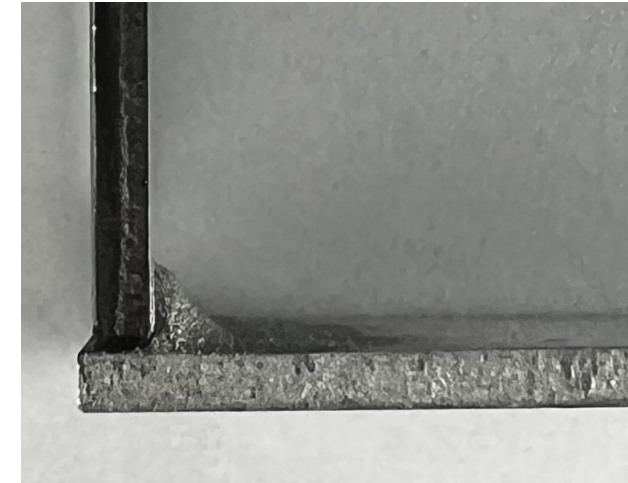
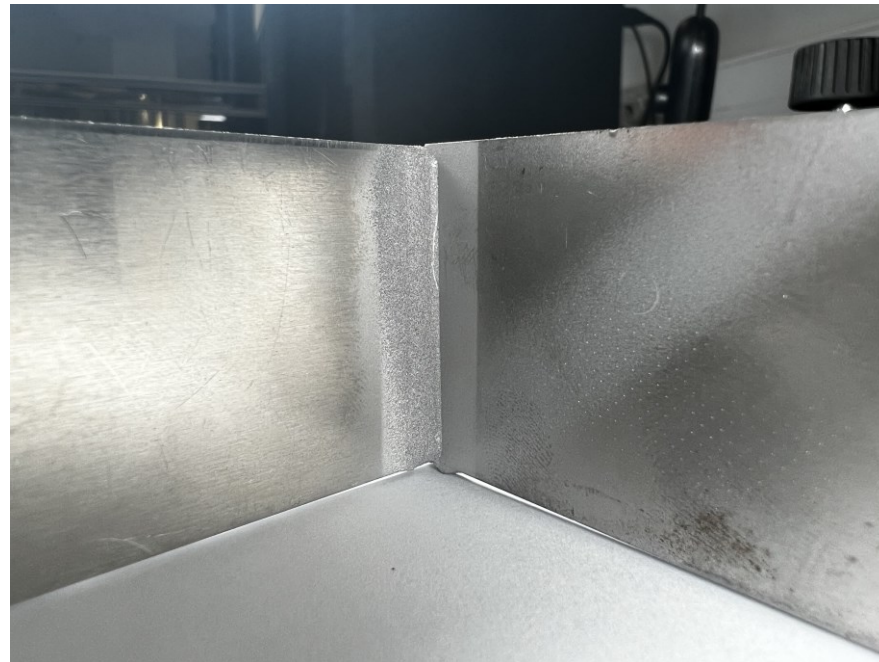
By hole covering

Steel



Shearing

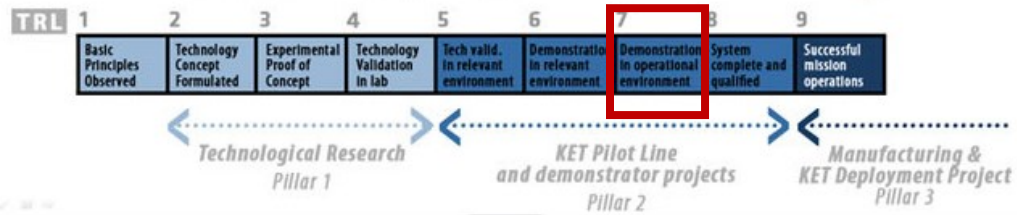
Not just flat...



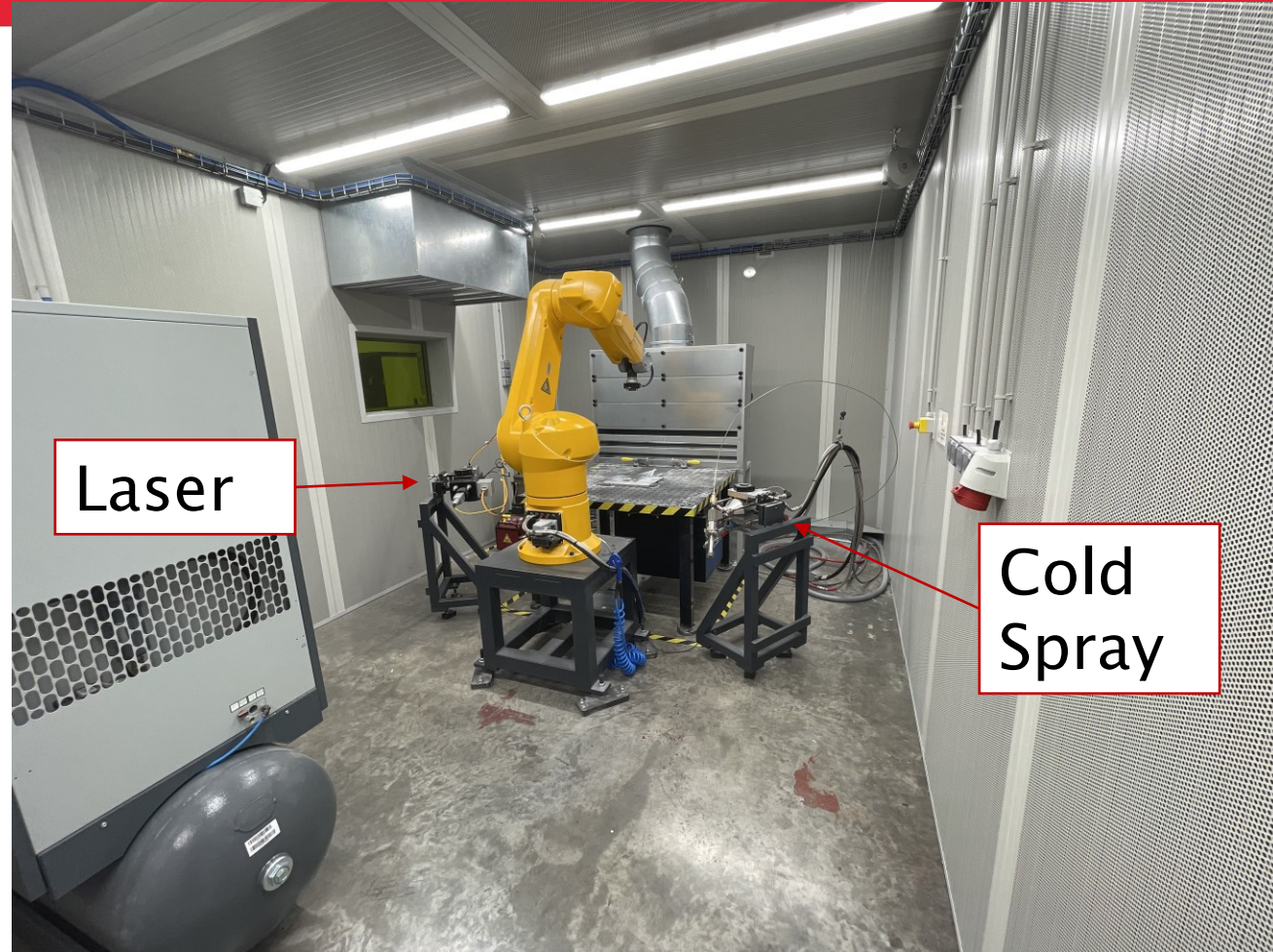
Welding position

Industrial demonstrator

Technology Readness Level Scale



Demonstrator in an industrial environment



Conclusion

- A new assembly process with an industrial platform
- Validate with other configurations
- Fatigue test with cyclic loading
- Corrosion





Questions ?

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