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Cold Spray with Confidence: Engineering Predictability in Cold Spray

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Last time we got together…

- I ranted about cold spray for about 15 minutes
- **Everything Matters!**
- Talked about the need for some cold spray specific heat treatments

Why are we here today?

- In a process where **everything matters**, how do you try to control the chaos…
- Some things we do at Polycontrols that help
- Show an example of a cold spray specific heat treatment we are developing
- Some things still in development…

Some things we are doing now…

Monitoring

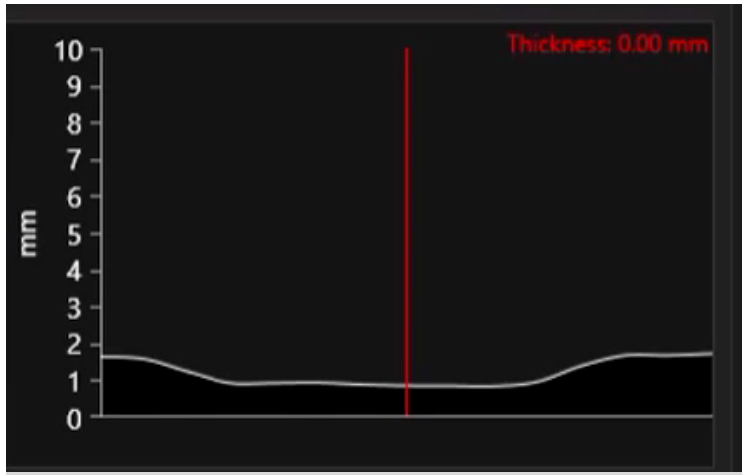
- The system has been seamlessly integrated into our **SmartCSAM** control platform, that way velocity data can be saved in the central repository.

- At **Polycontrols**, we strongly believe that non-destructive sensors add significant value to process ruggedness and control.

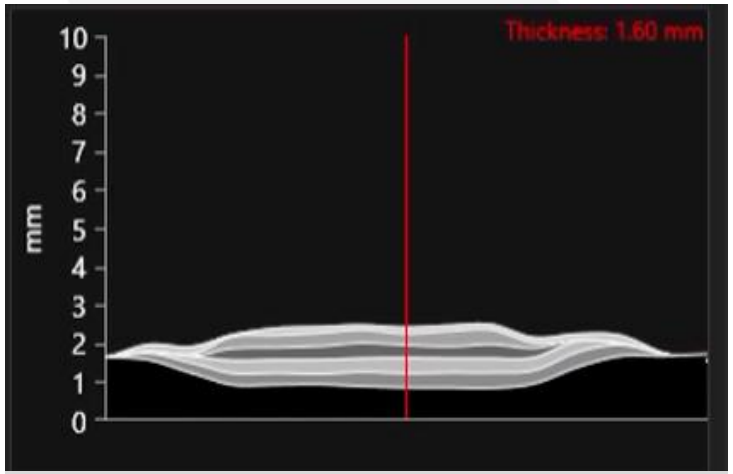
Dimensional Characterization & Stand-off Control

- Ensuring constant spray distance (SOD) and spray angle.
- Scanning to obtain initial surface **profile** prior to spraying.
- Knowing how much has been put down (online **thickness** measurement).

Automatic stand-off control



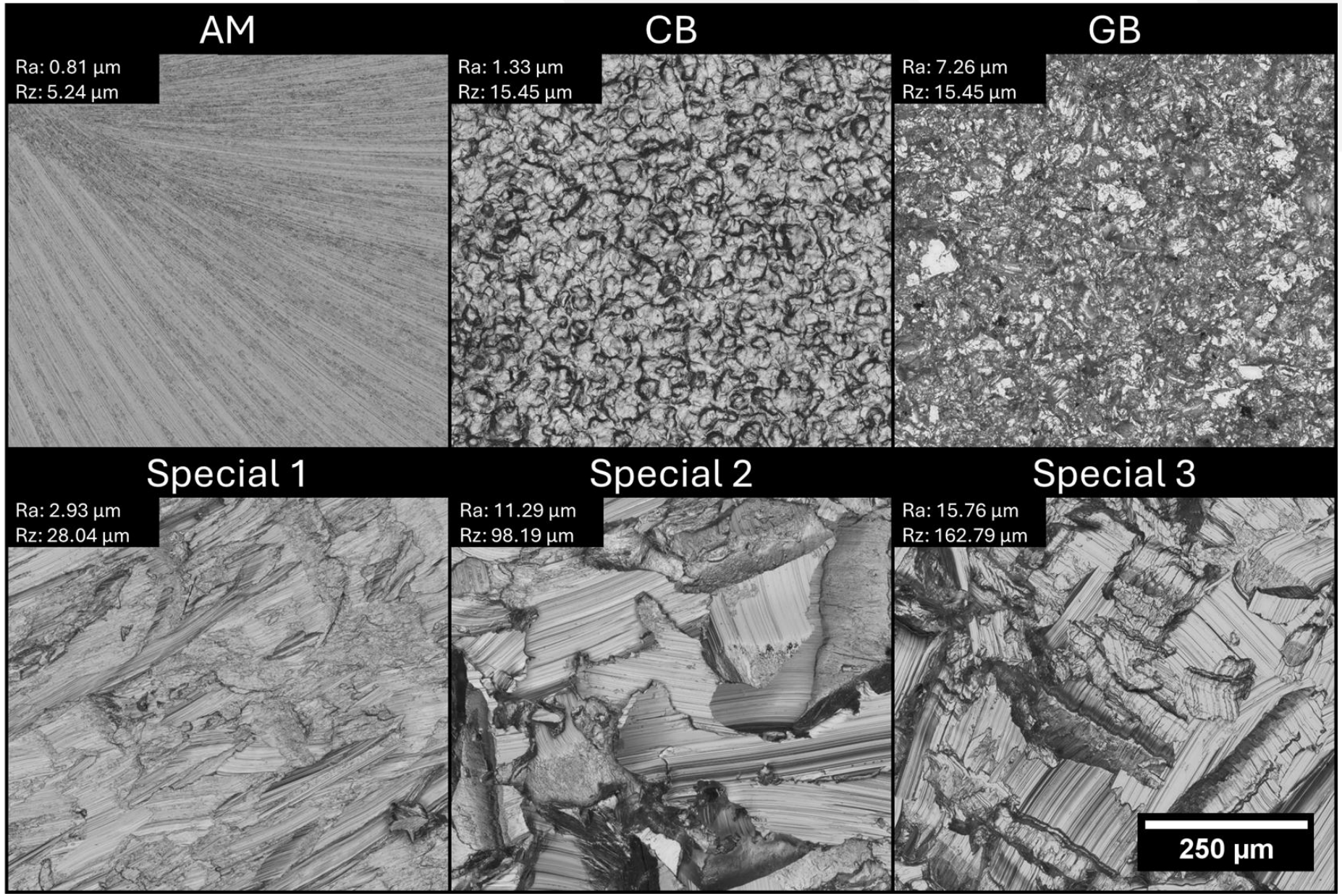
Online base profile measurement



Online thickness measurement

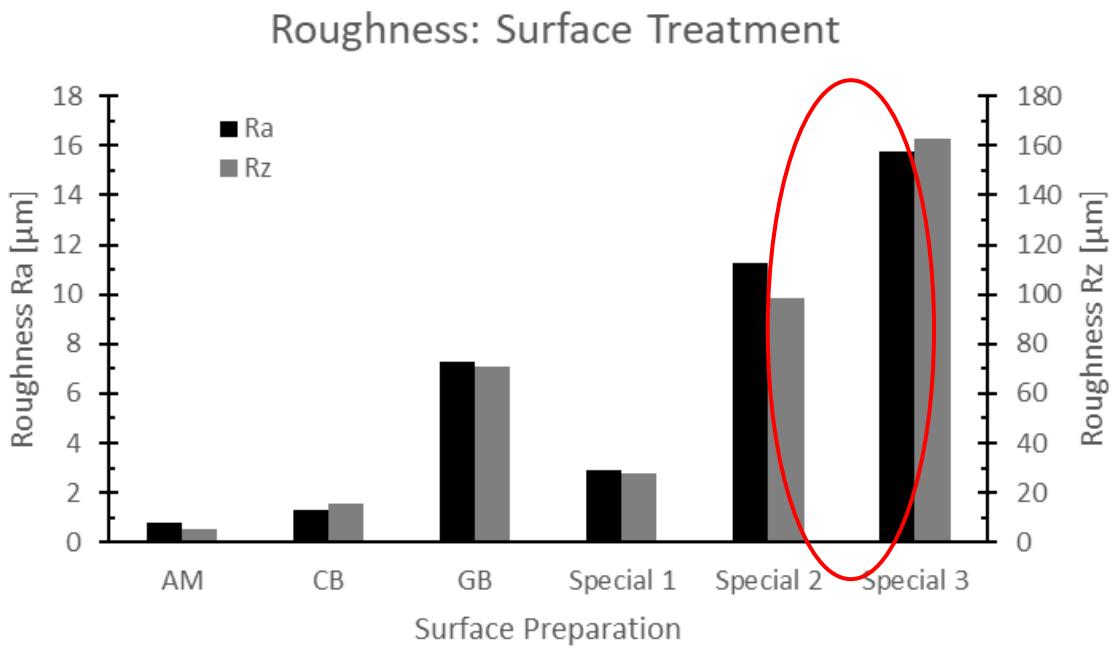
Preliminary Surface Preparation Studies

- New powder/ substrate combinations come in all the time
- Each requires R&D
- Everything matters, like substrate prep

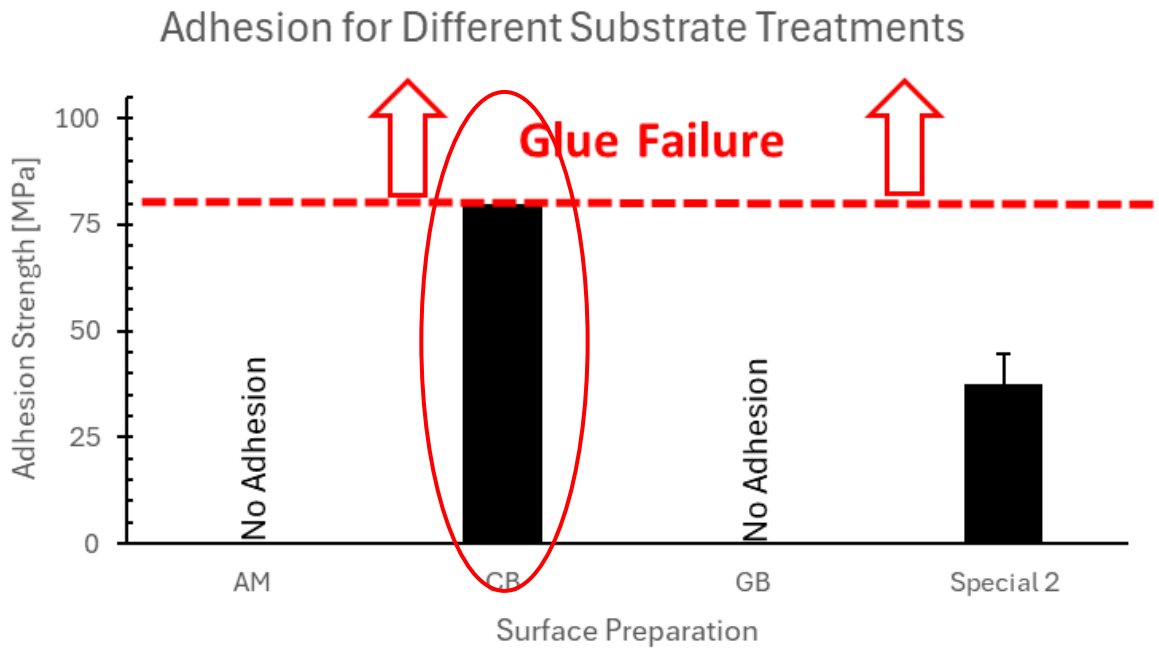


Preliminary Surface Preparation Studies

Material Combination 1



Material Combination 2



What about a different material combination?

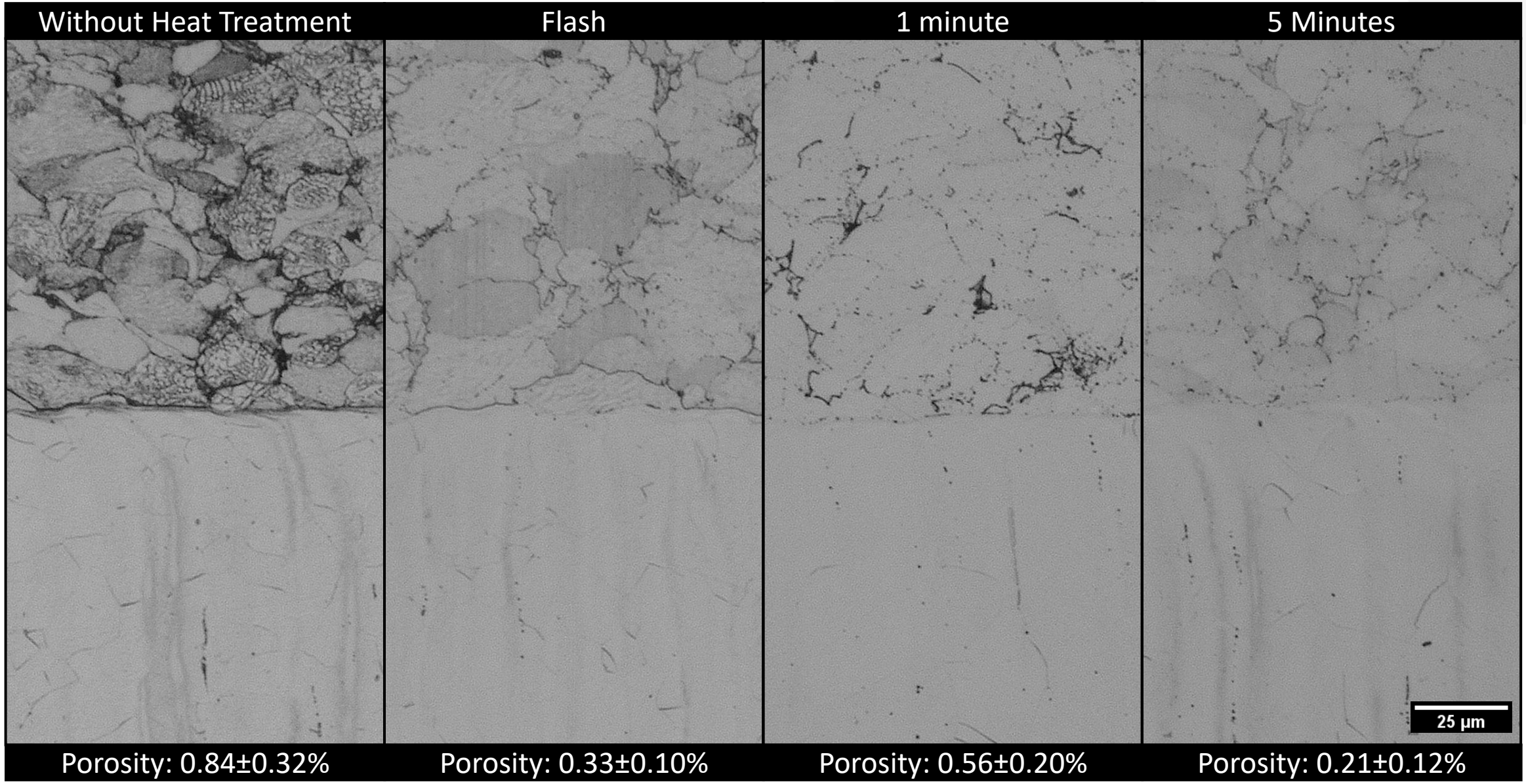
Everything Matters!

Cold Spray Specific Heat Treatments with Induction Heating

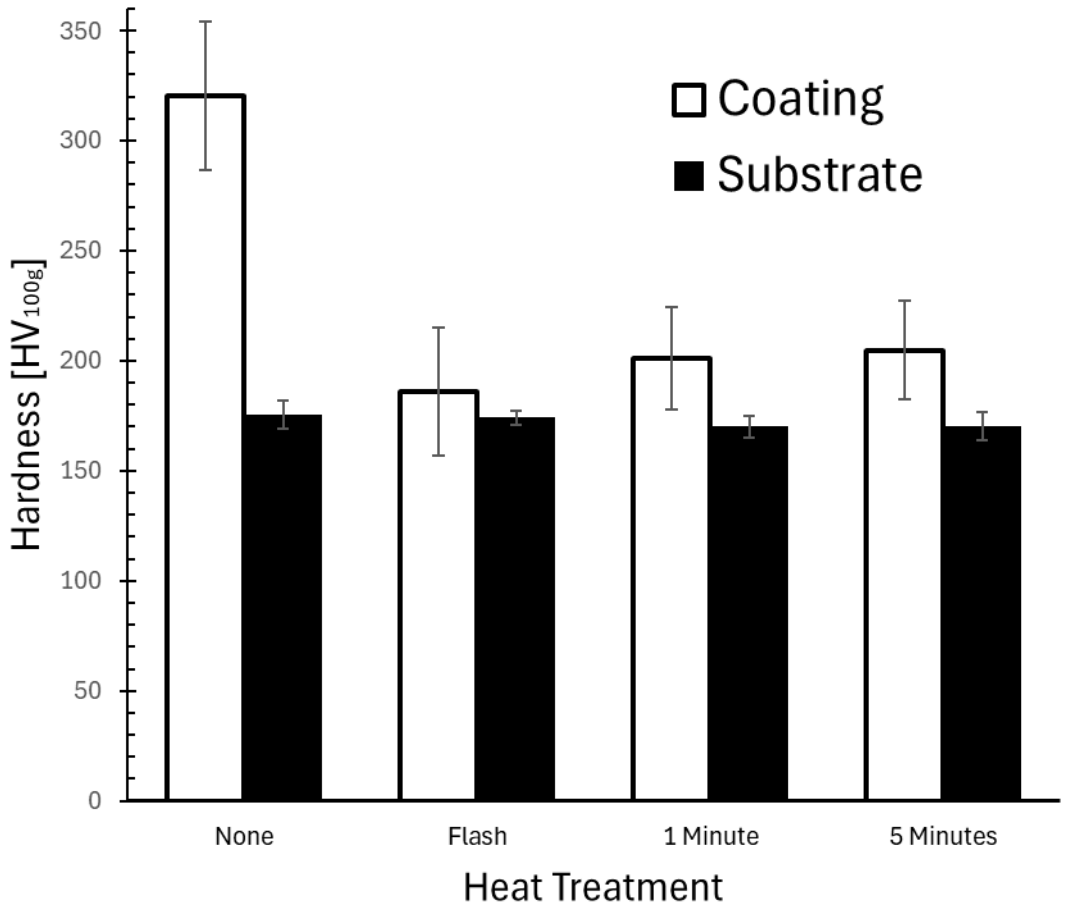
- Determine the time and temperature at which induction heat treatments enhance specific properties of different materials, optimizing efficiency for practical applications

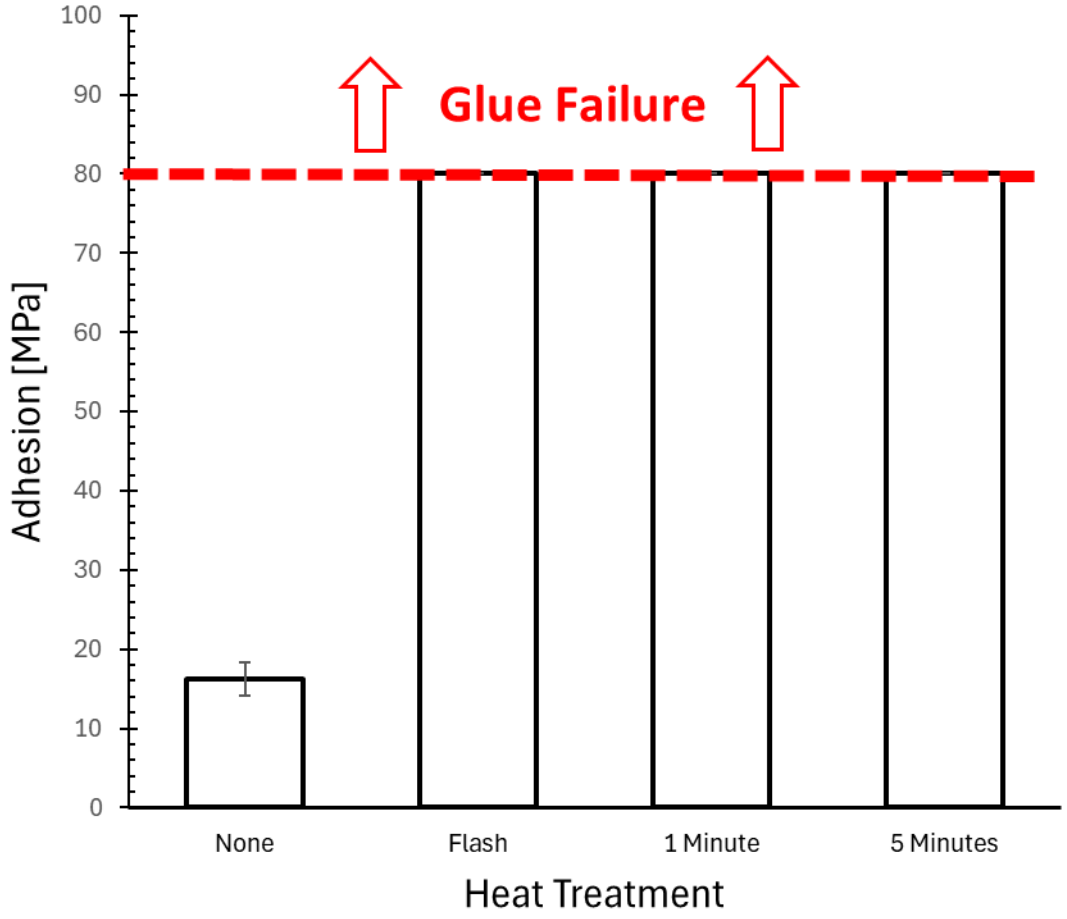
- Successfully integrate induction heating into the robotic system at PolyCSAM, enabling precise, automated, and localized heat treatment

316 Stainless Steel on 316 Stainless Steel: HT @ 80% Melting Temperature (K)



316 Stainless Steel on 316 Stainless Steel





Induction Heat Treatment

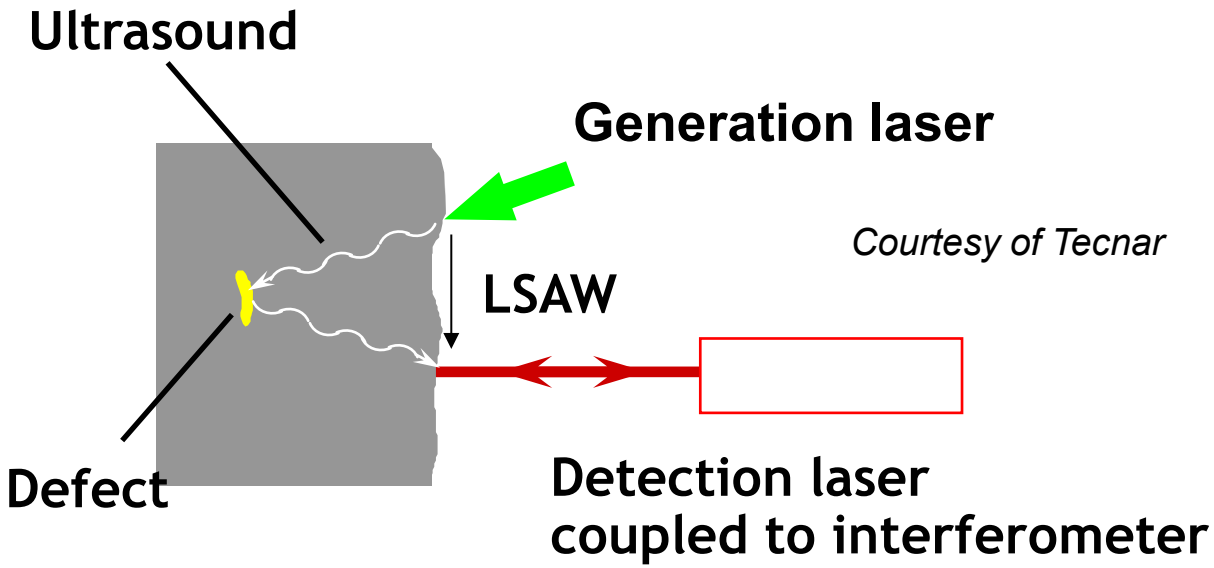
Key Findings

- **Overall improvements:** All heat treatments enhanced adhesion, reduced hardness, and reduced porosity.
- **Flash heat treatment:** Achieves most of the benefits seen in longer heat treatments.
- **Stainless steel results:** Adhesion went from under 20 MPa to breaking glue above 80 MPa with a flash heat treatment. Coating hardness matched the substrate, with no impact on substrate hardness.

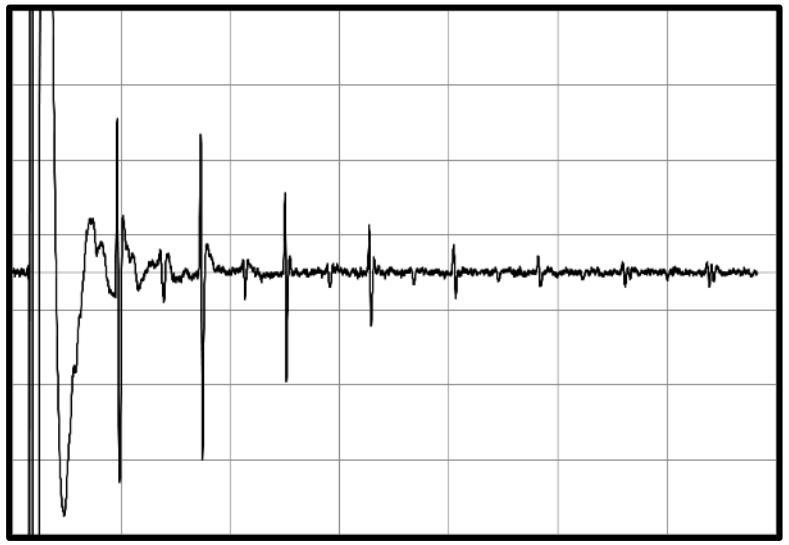
- Future work:
  - Expand material scope
  - Temperature refinement
  - Robotic scanning optimization
  - Tensile testing
  - Comparison with traditional heat treatment

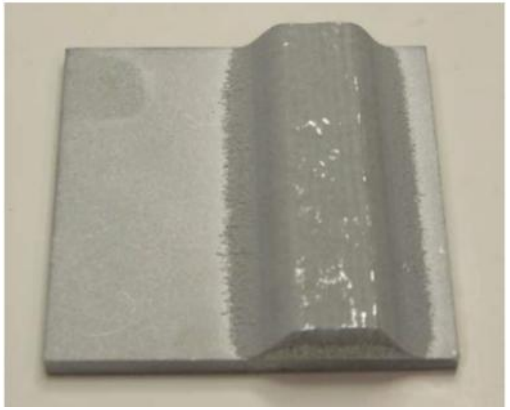
In development...

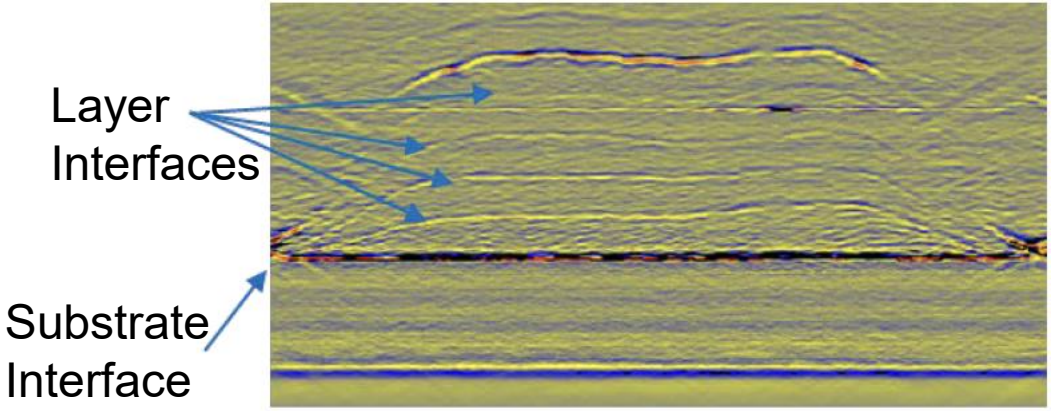
Laser Ultrasonics: Identify Defects, Interfaces, or Porosities



Courtesy of Tecnar

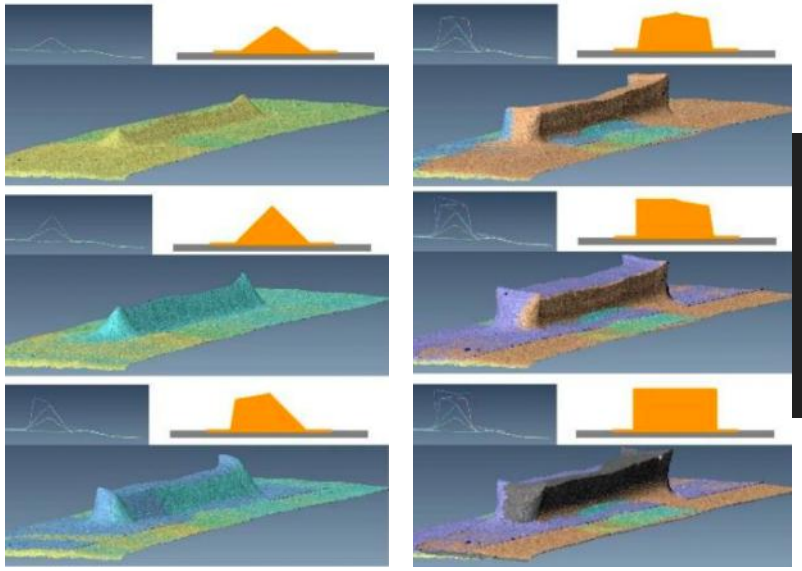






Courtesy of NRC

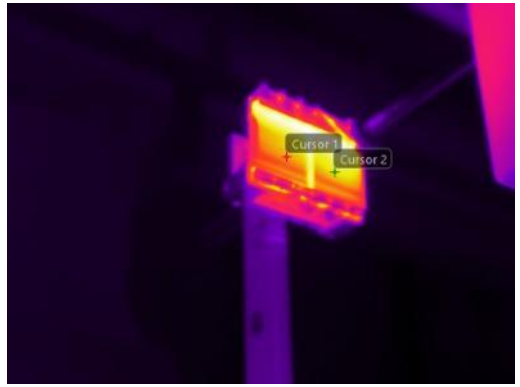
Other sensor integrations in the works…



OCT - Optical Coherence Tomography applied to build-up profile characterization

(CSAM Industrial R&D Group, NRC-Canada)

IR imaging to monitor and control thermal state/history of the part



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Contact us

Let’s Work Together

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