



Characterisation of Wire Arc Additive Manufactured Superalloys

Introduction & context

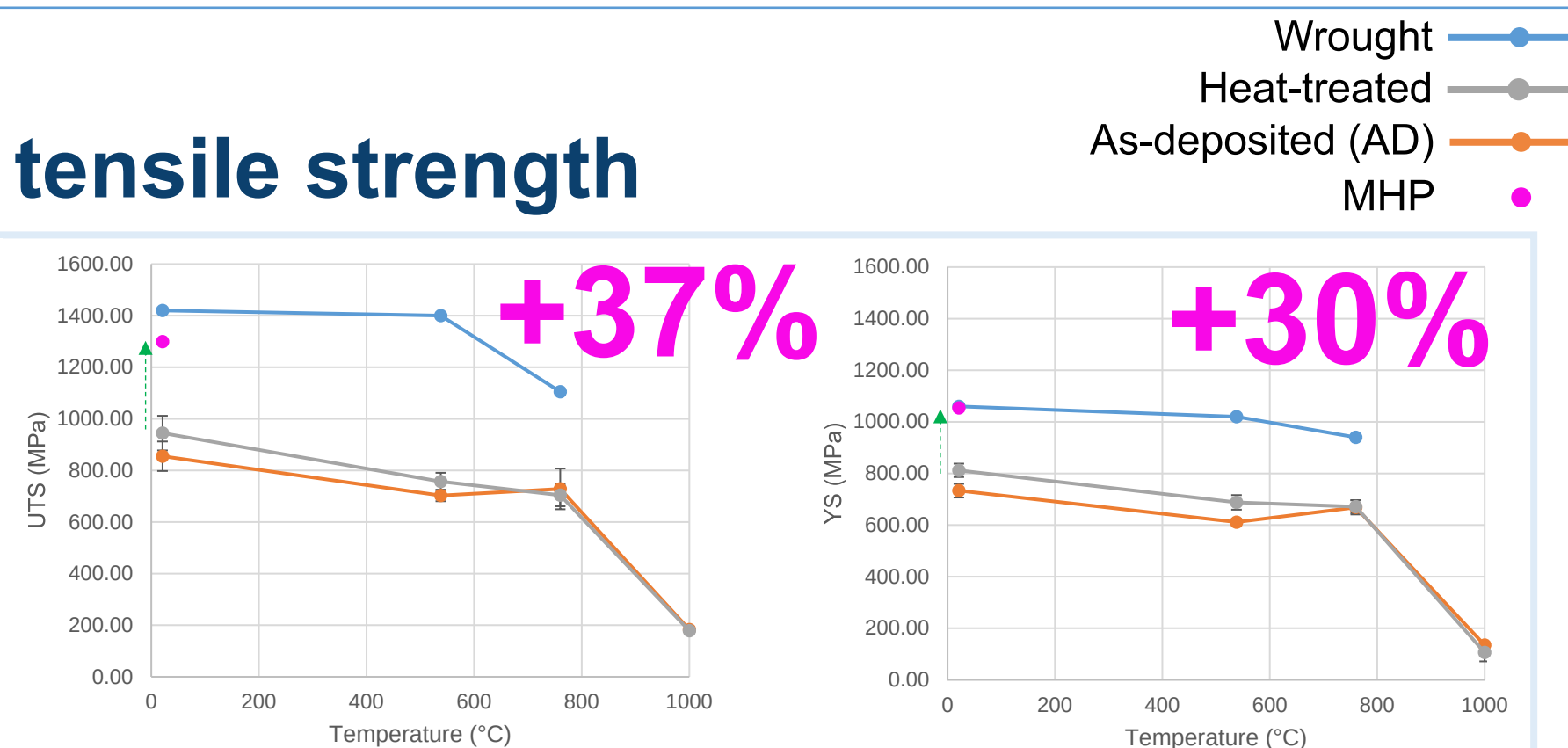
- Wire + Arc Additive Manufacturing (WAAM), is a metal 3D printing process, using an electric arc as a heat source and wire as a feedstock.
- Two superalloys were characterised to understand the response of WAAM superalloys for high temperature applications.
- Aim to understand if **machine hammer peening (MHP)** can be used to obtain a performance similar to the wrought alloys.

Results

High temperature tensile strength

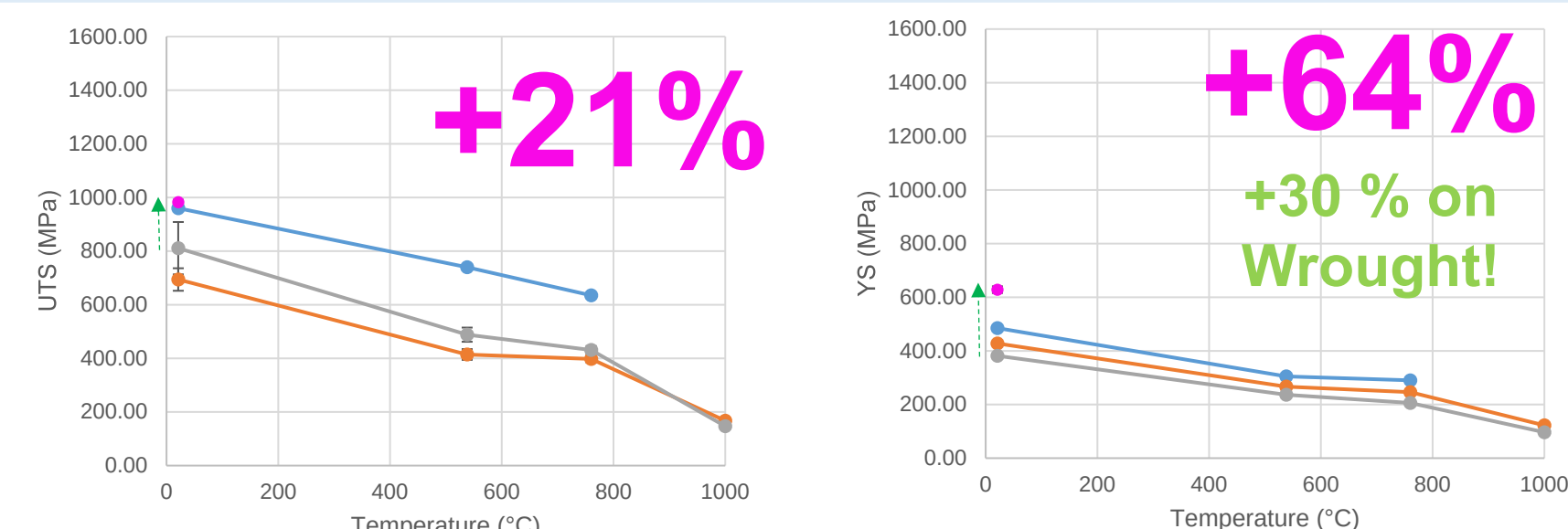
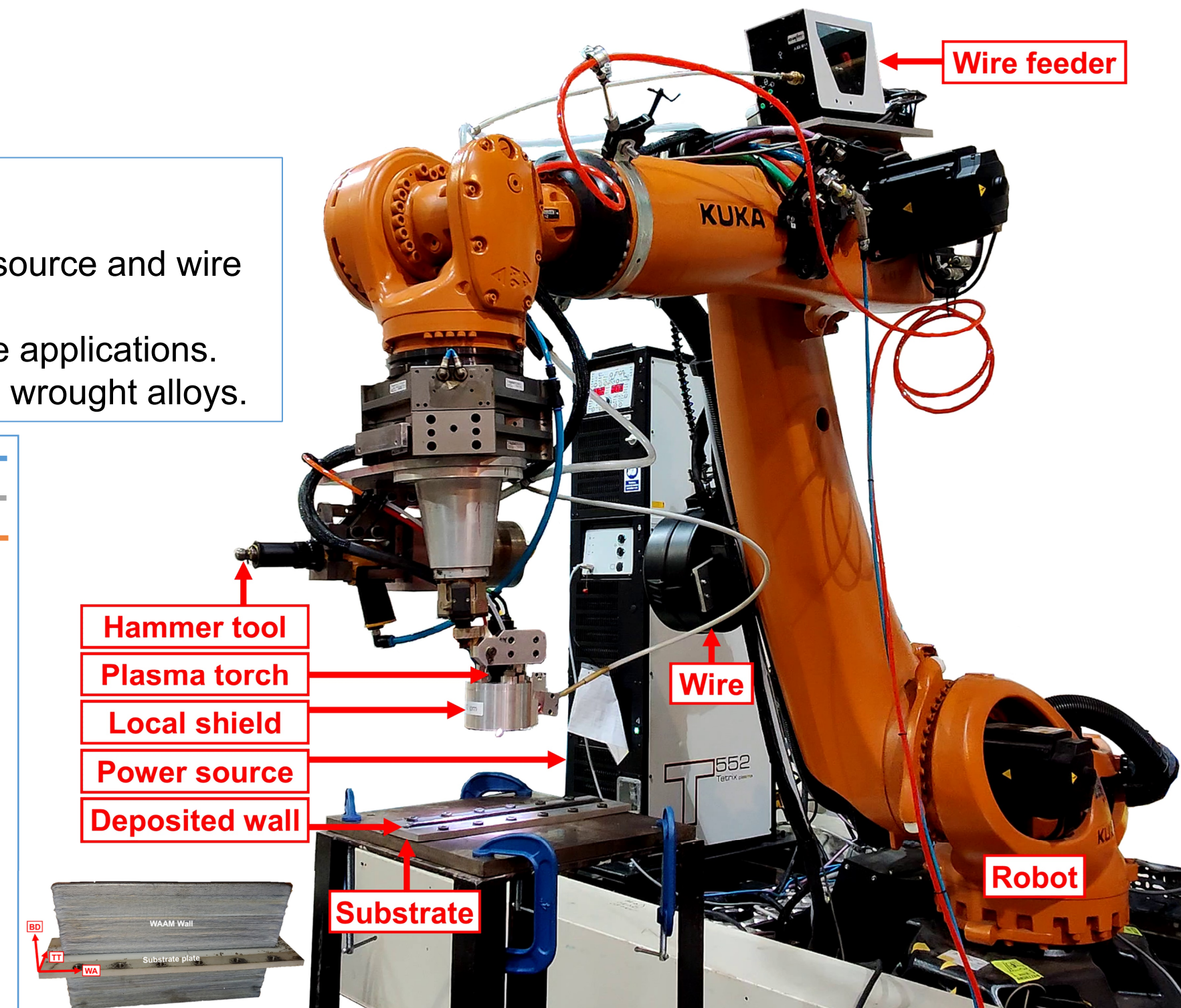
Rene 41 (RE41)

- Ni-based
- Precipitation strengthened
- Gas turbine structural components

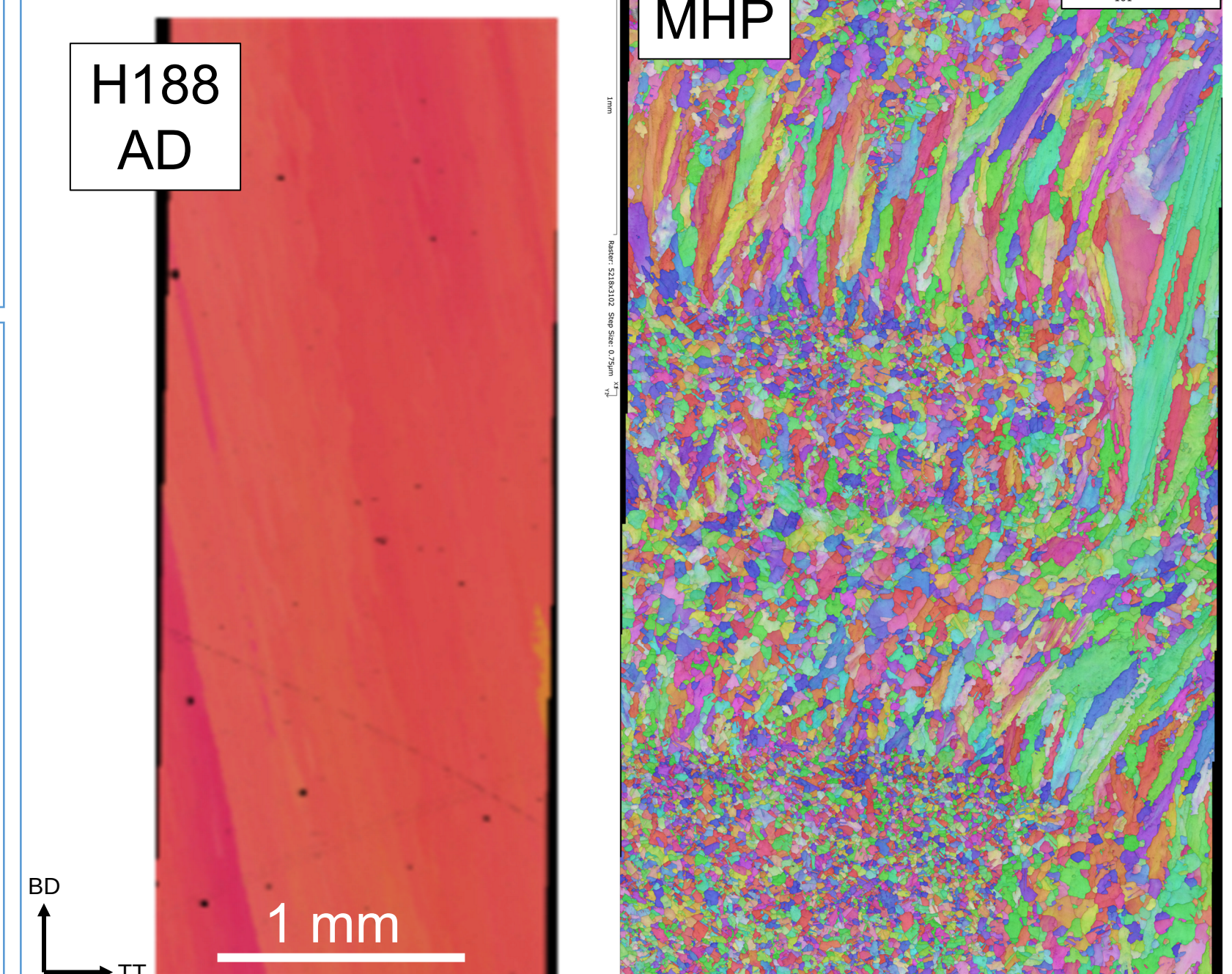


Haynes 188 (H188)

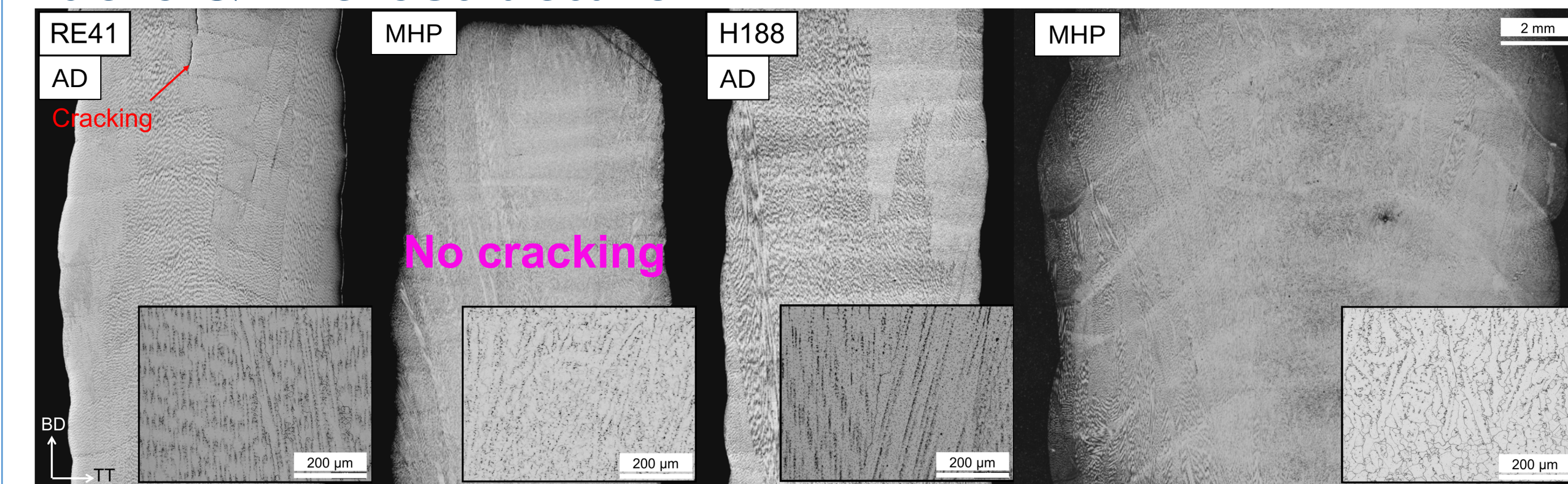
- Co-based
- Solid solution strengthened
- After burner components, space shuttle engines



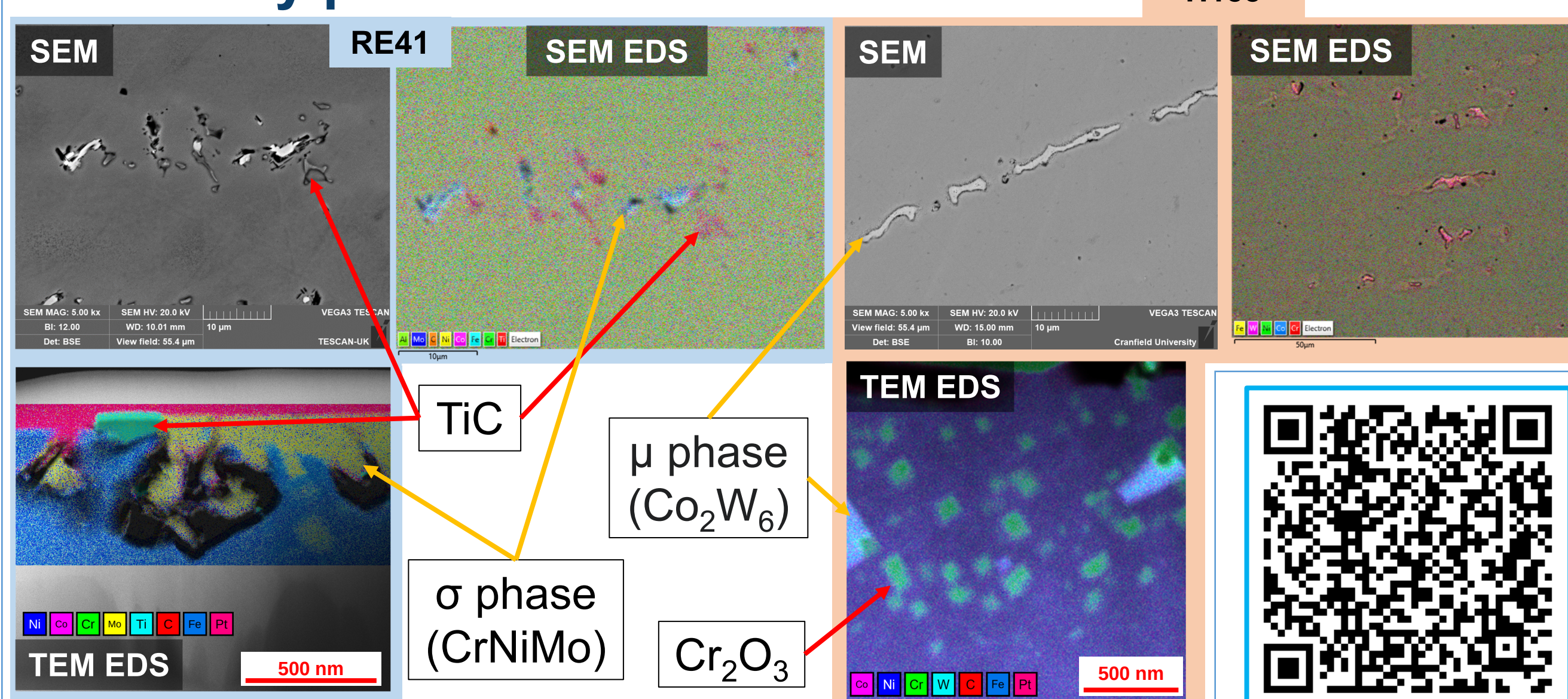
In-process cold working & Grain refinement



Macro & microstructure



Secondary phases in AD condition



Conclusions

- ✓ **Inter-pass MHP greatly increases tensile performance.**
 - This is due to the effect of a greatly refined microstructure.
- ✓ **MHP eliminated cracking in RE41.**
 - Likely due to relaxation of thermal stresses, and fragmentation of second phases. No cracking was observed in H188.
- MHP has no effect of formed phases.
- Standard heat-treatment does not dissolve detrimental phases.
- Solid solution strengthened WAAM alloy performs better than precipitation hardened.

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