SAND2015-20750PE

Exceptional service in the national interest

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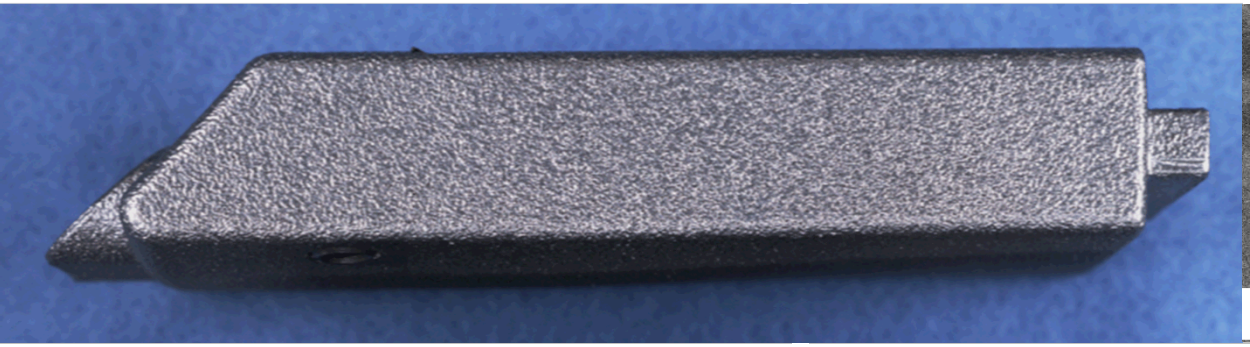

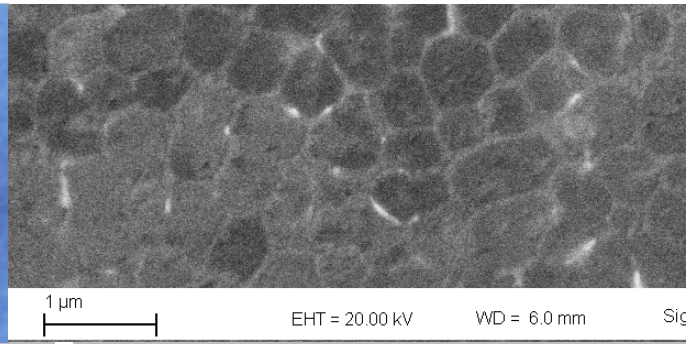

AM aluminum part findings

Lisa Deibler, Dante Berry, Jeff Rodelas Don Susan

1-7-15

U.S. DEPARTMENT OF ENERGY | NNSA National Nuclear Security Administration

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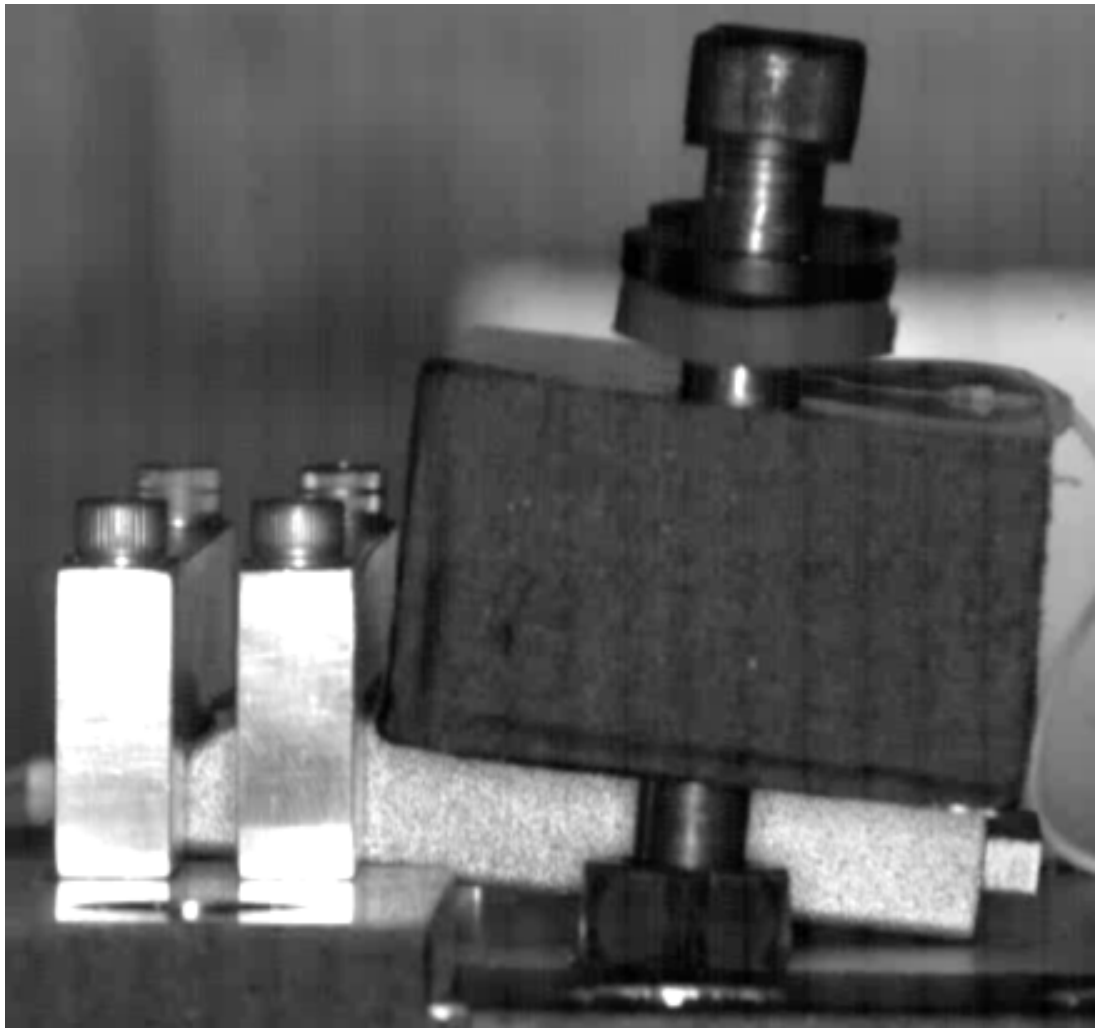
Part requirements

- Electrically conductive
- No cracking under impact load.

Drop test 32 ft/sc



Sample after impact at 26 ft/sec

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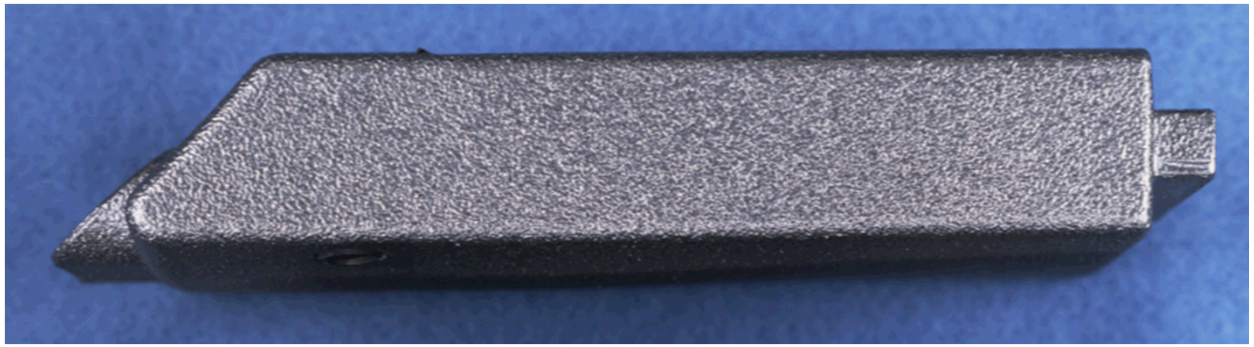
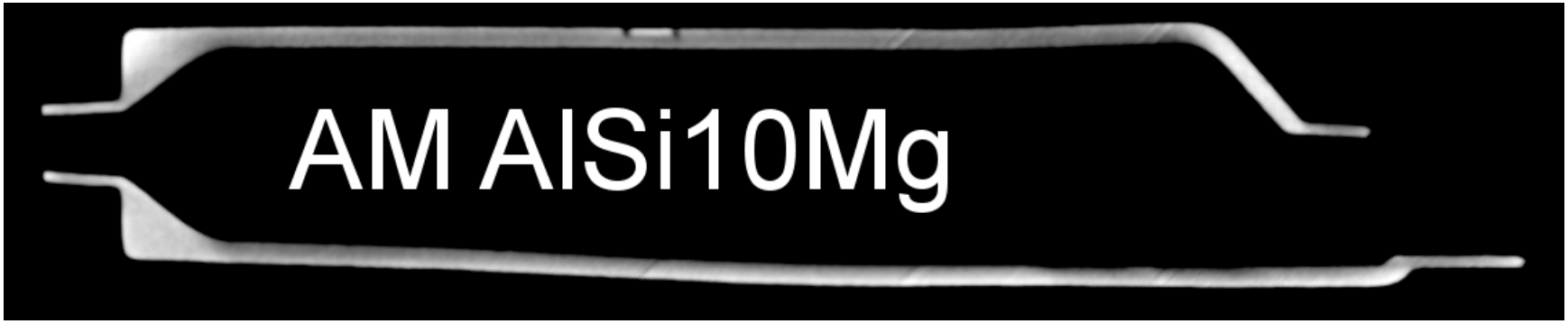
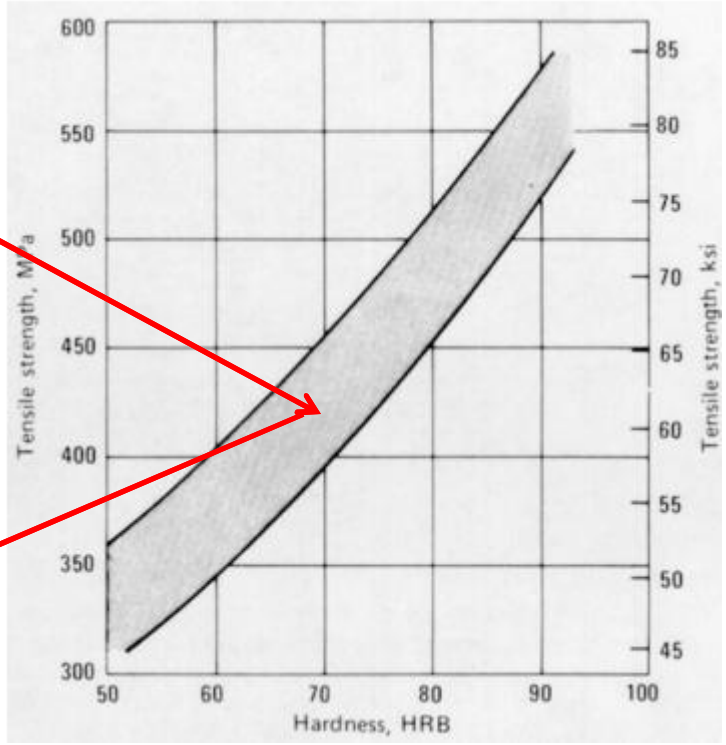




Approximate hardness conversion

130 HV 100gm

35 ksi yield, 60 ksi ultimate, 4% elongation.



Heat Treating of Aluminum Alloys, *Heat Treating*, Vol 4, *ASM Handbook*, ASM International, 1991, p 841–879 (Quality Assurance section)

Transverse view of AM part

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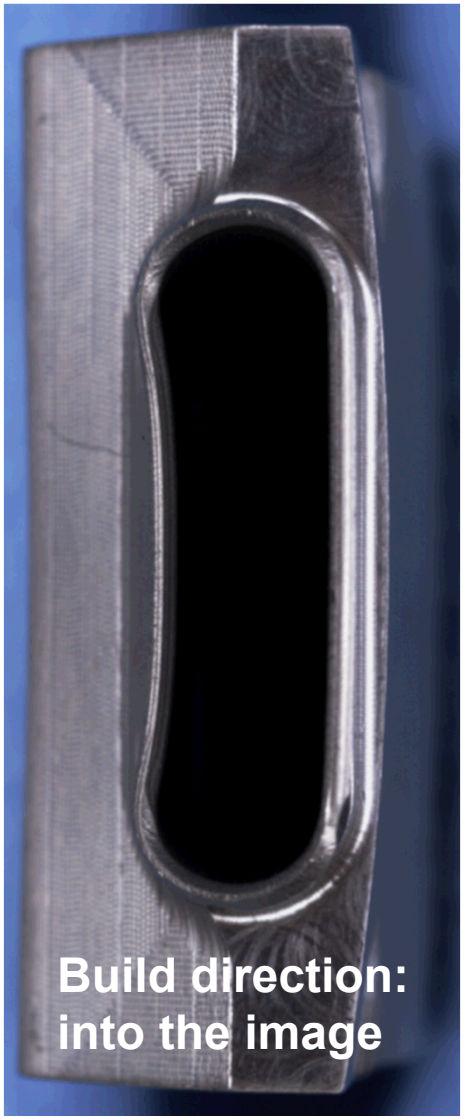
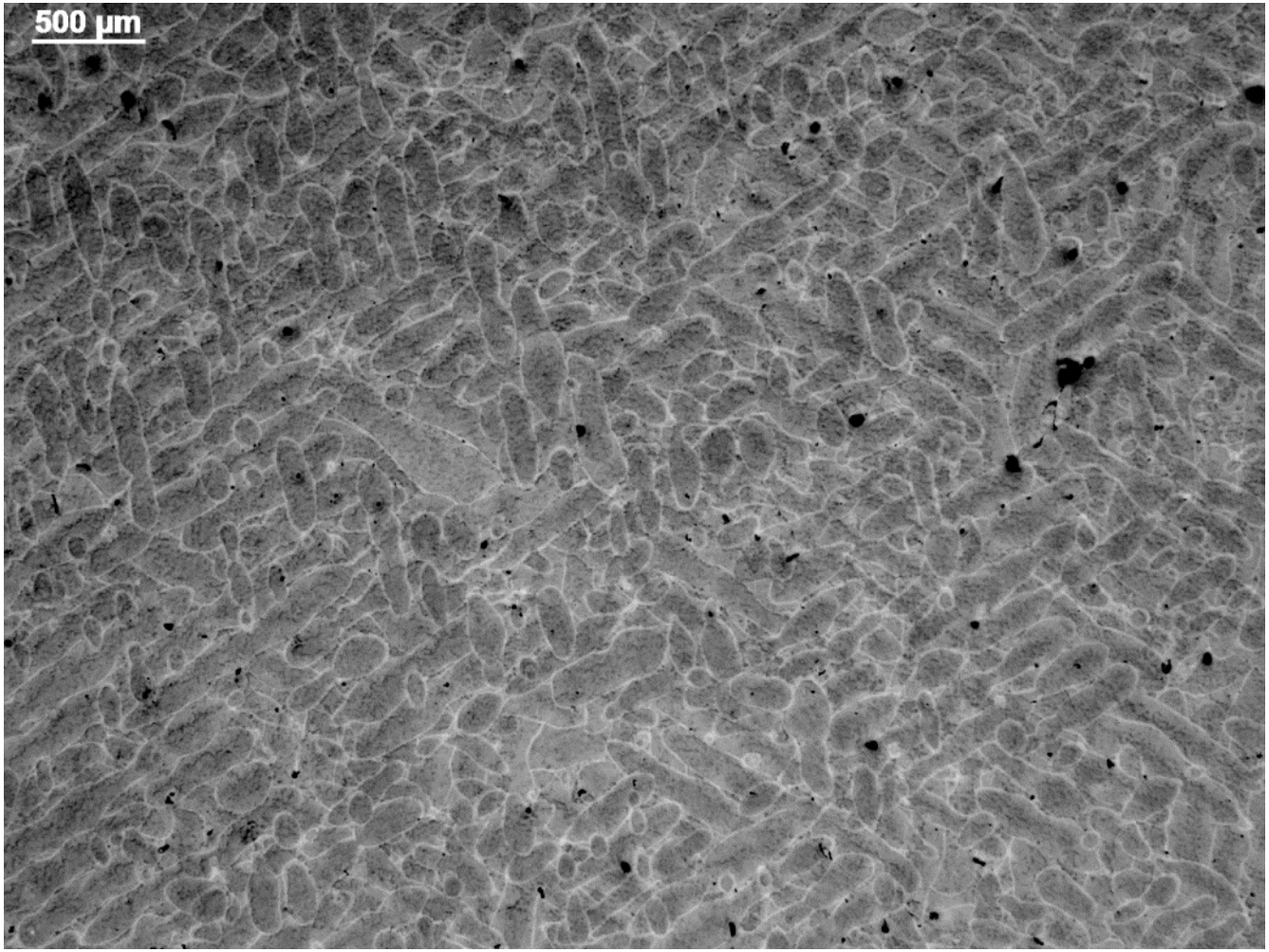
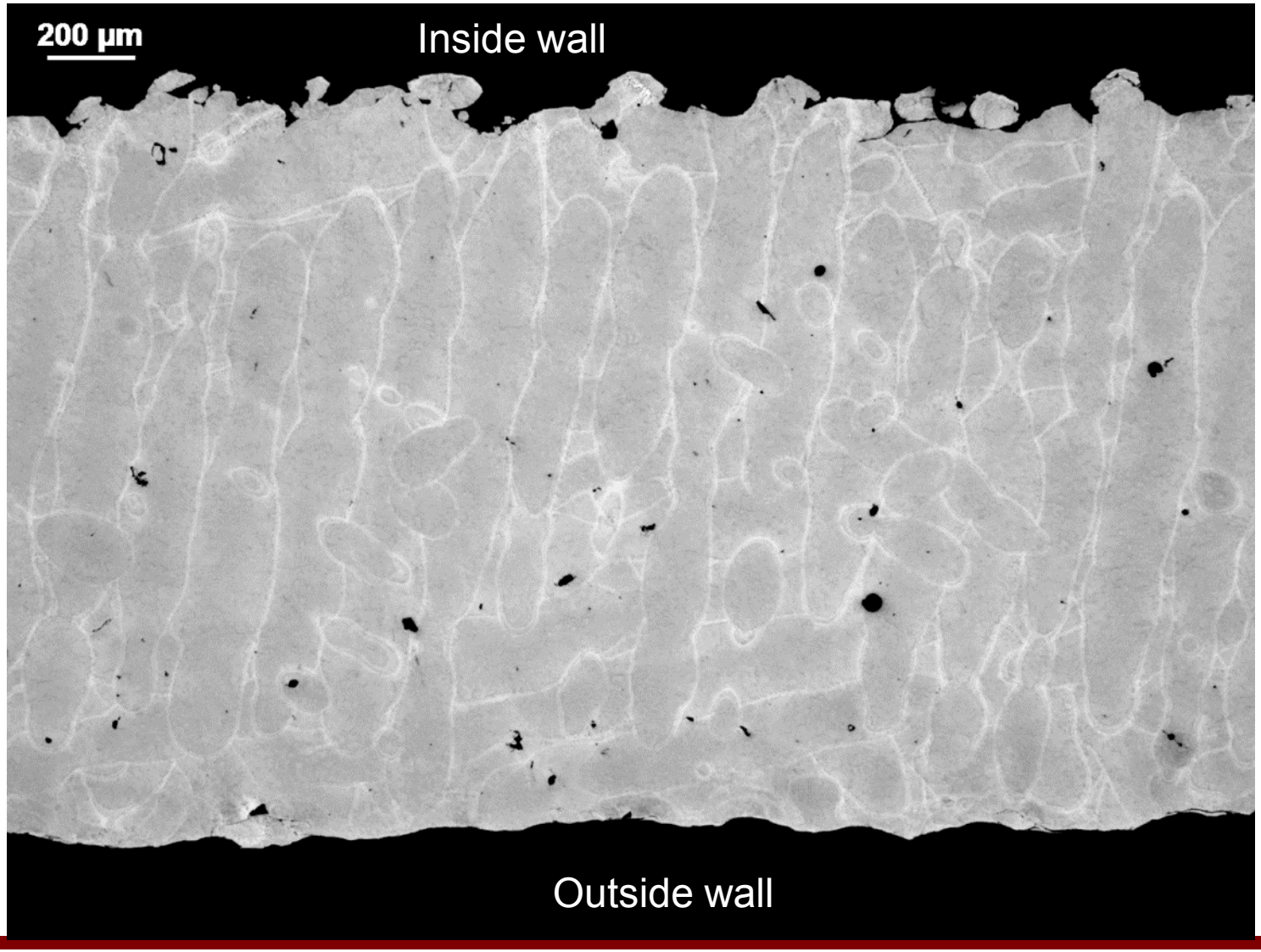




Transverse view of wall



Transverse vs. longitudinal views

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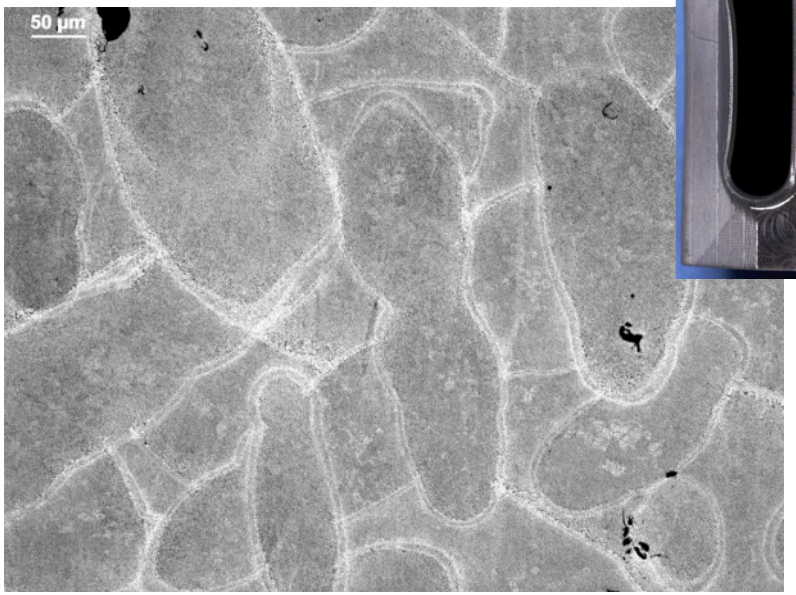
Longitudinal

Transverse



Channeling contrast images

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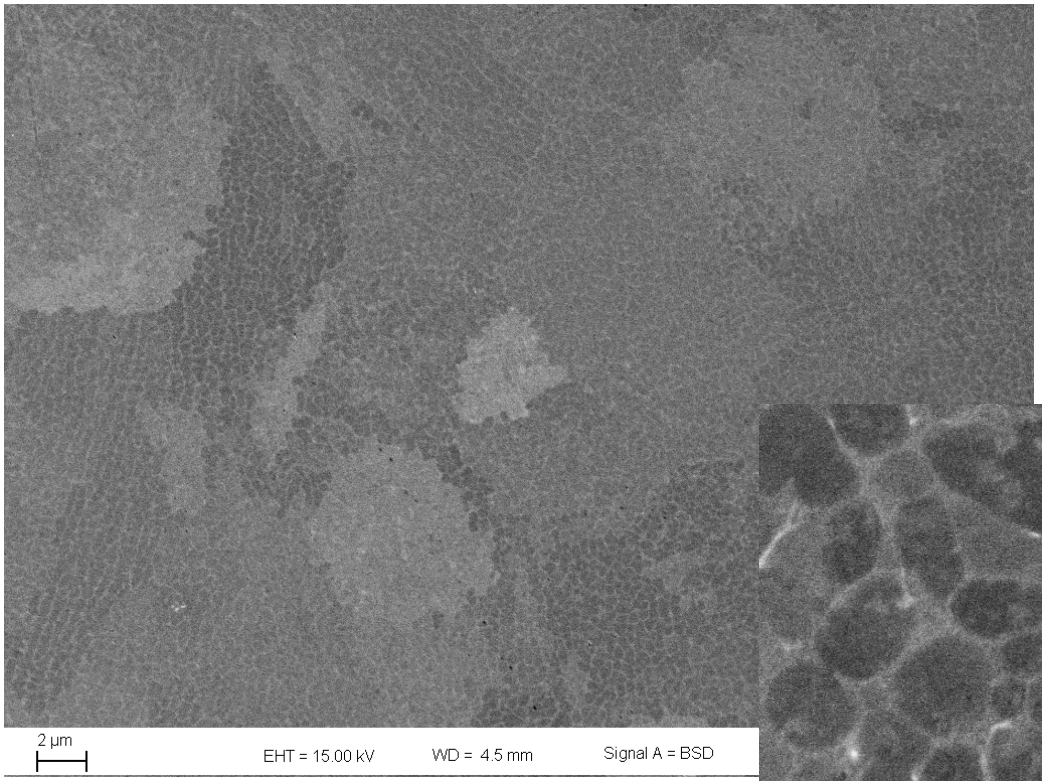
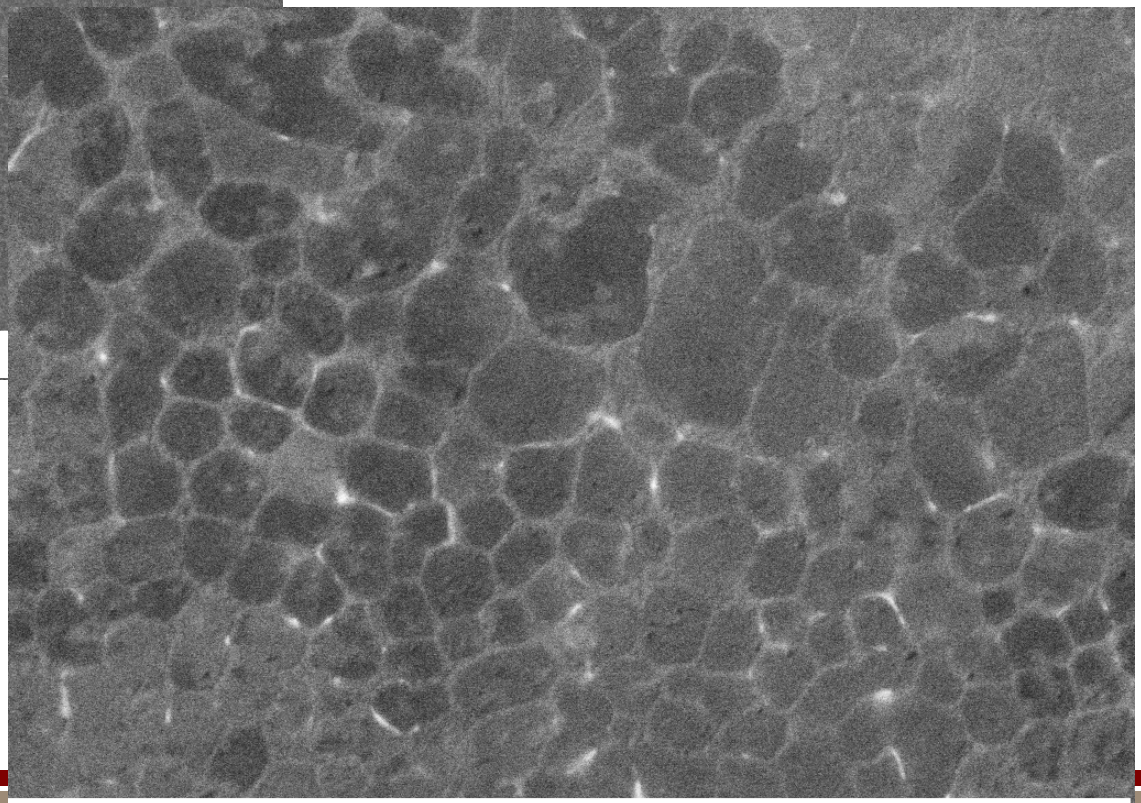
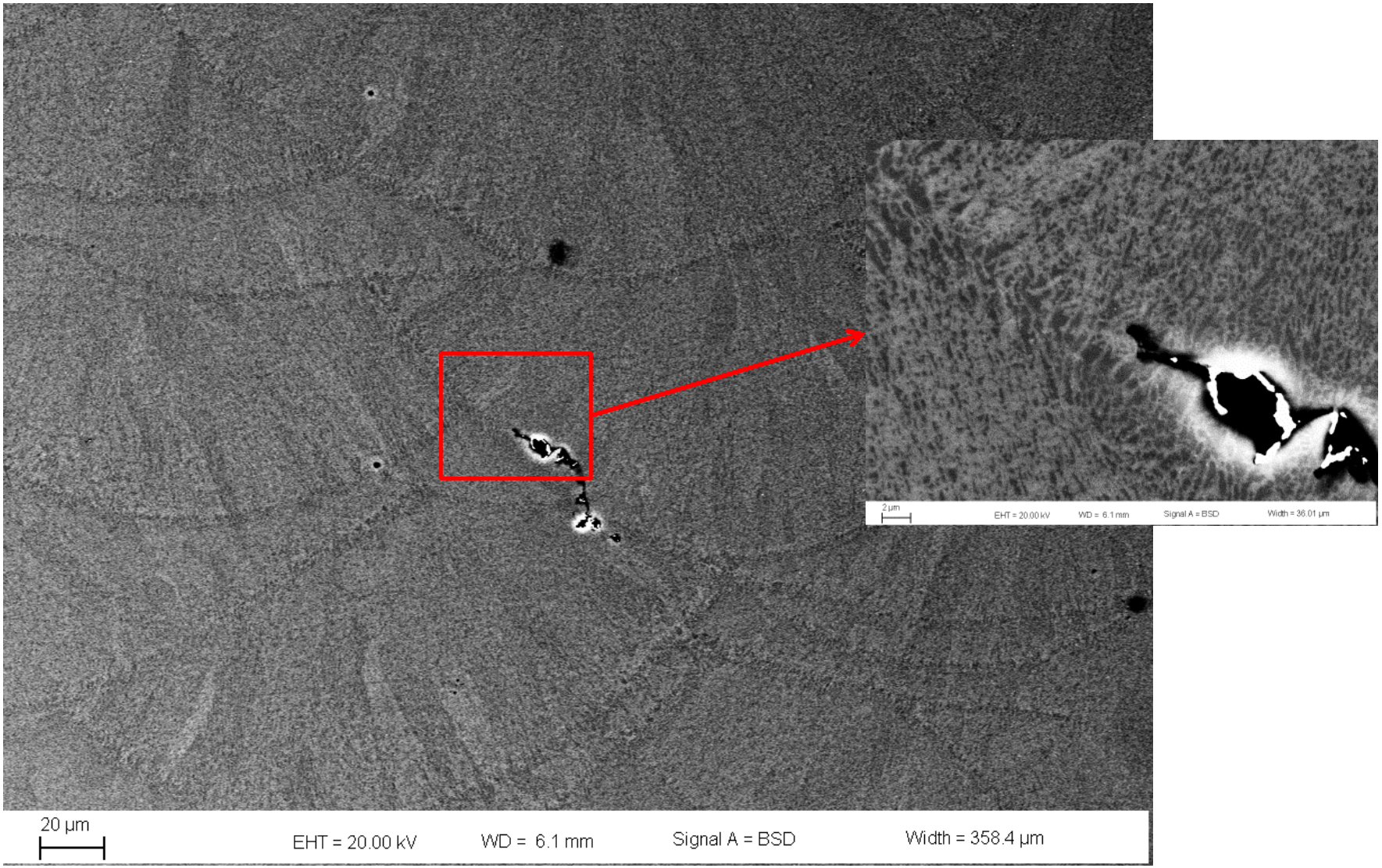
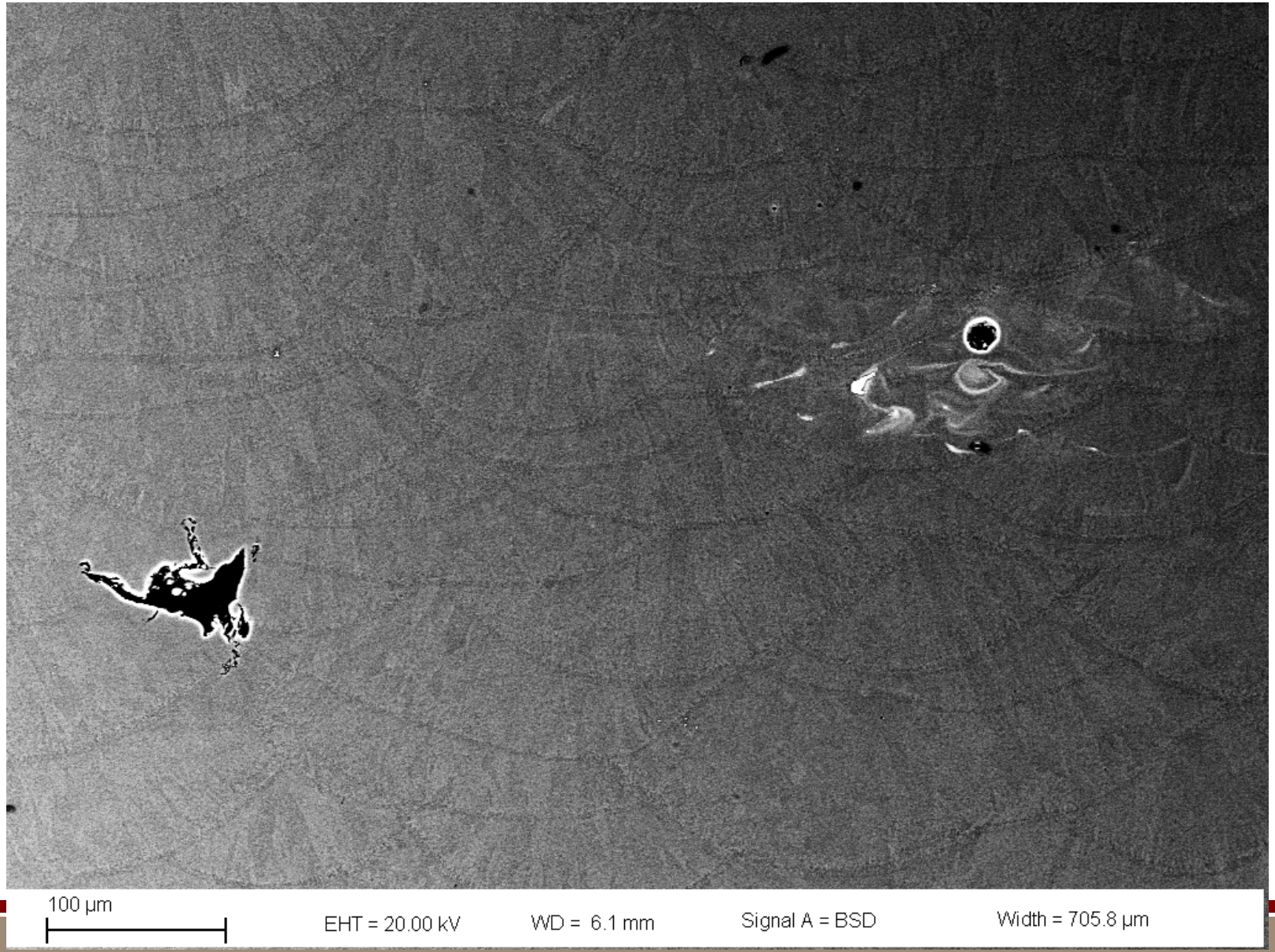




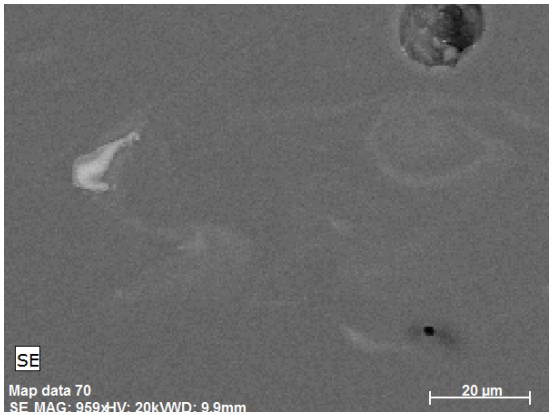
Solidification cracks

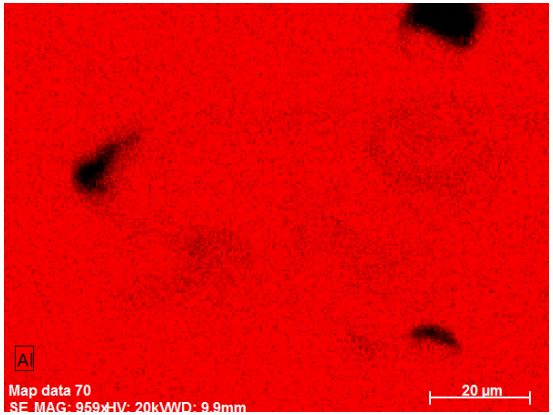


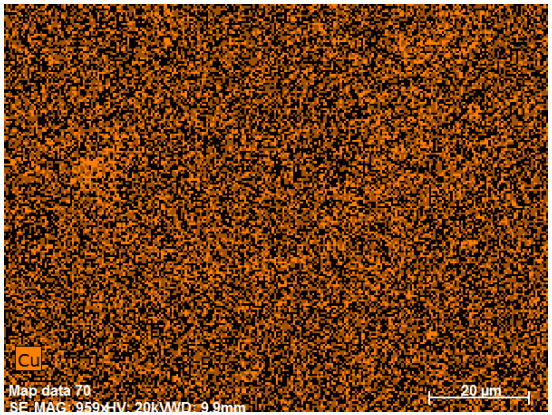
Cracks and impurities

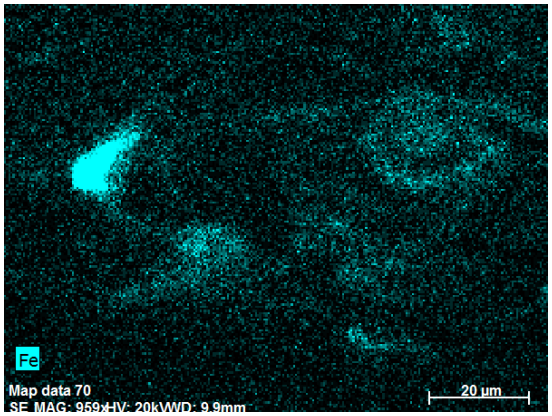


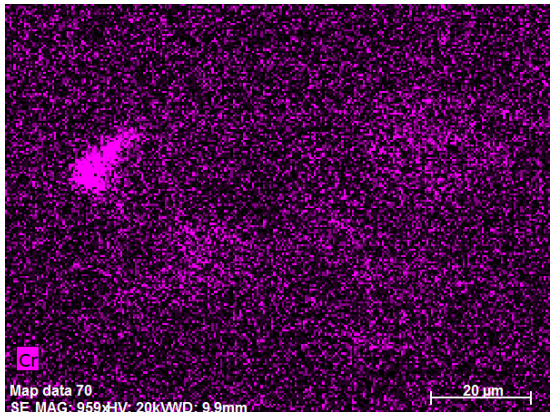
Stainless steel impurity

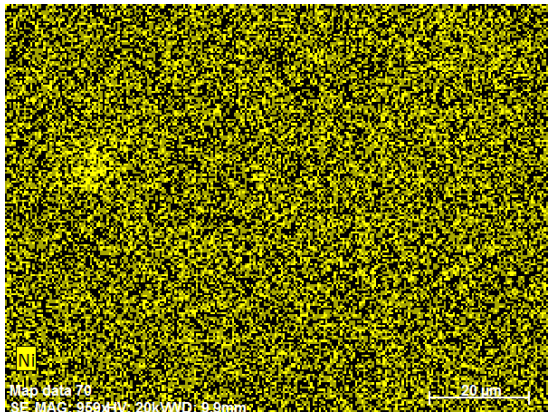




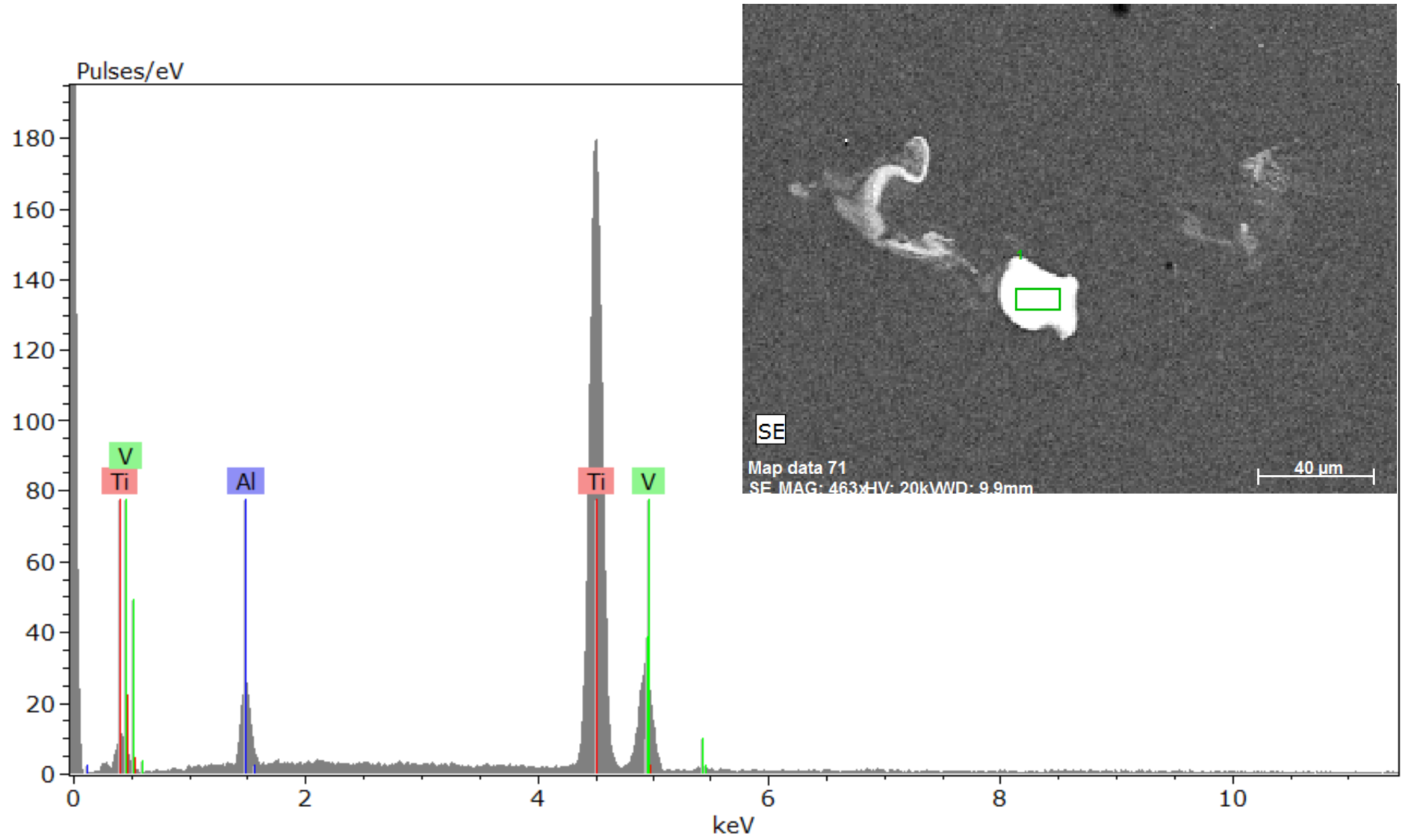








Titanium-Vanadium impurity



Path forward

- Material testing: Tension, Charpy, Fatigue life, Notch tension, Room temperature creep, Stress corrosion cracking, Corrosion compatibility, Residual stresses