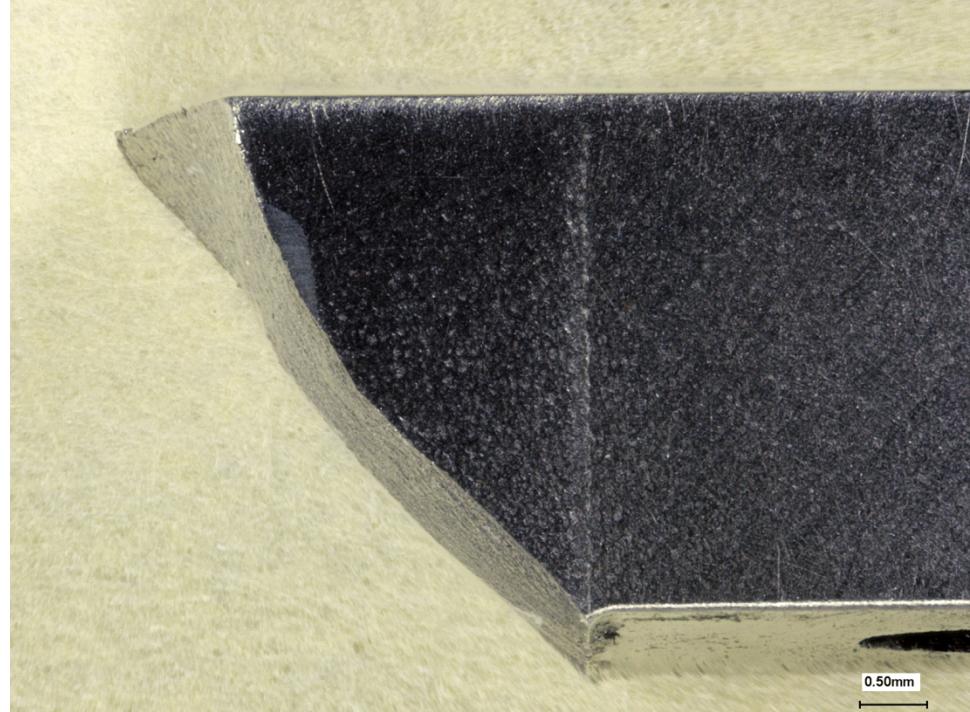


Wedge Assembly Failure Analysis

Kevin Jameson

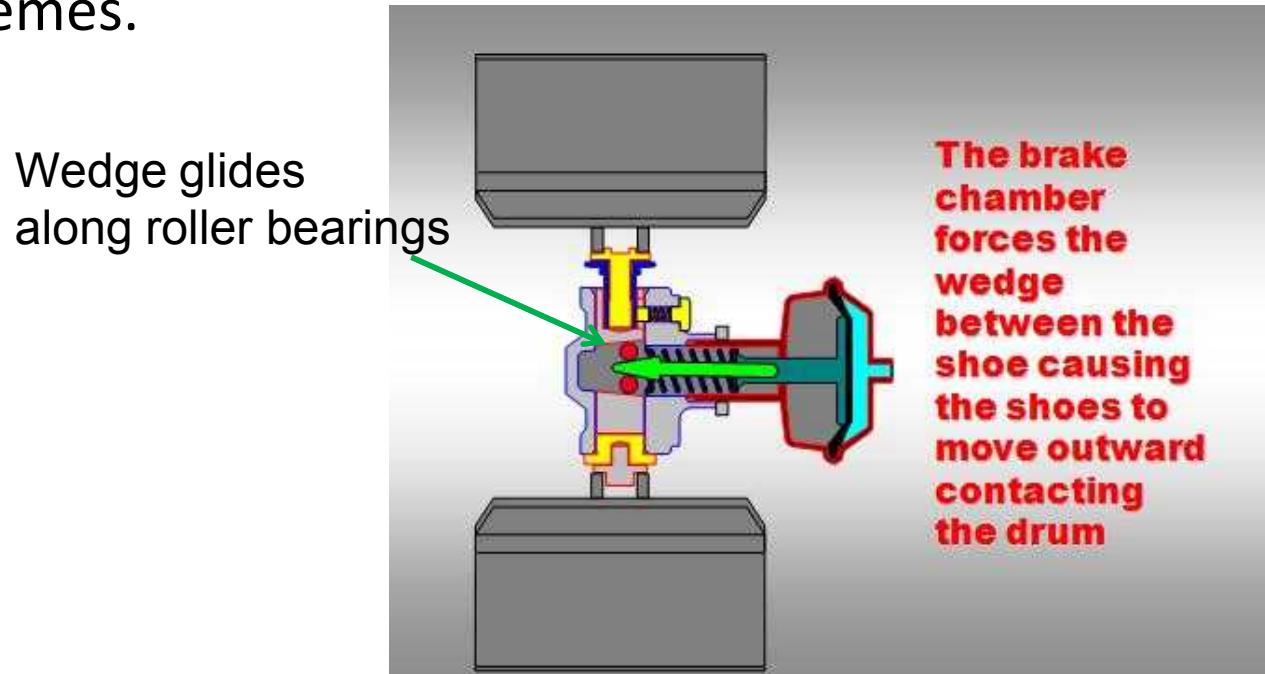
April 23, 2014

*Exceptional service
in the national interest*



Background

- The wedge brake is a type of brake system for commercial over-the-road tractor trailers.
- Harsh environment: water infiltration, vibration, temperature extremes.

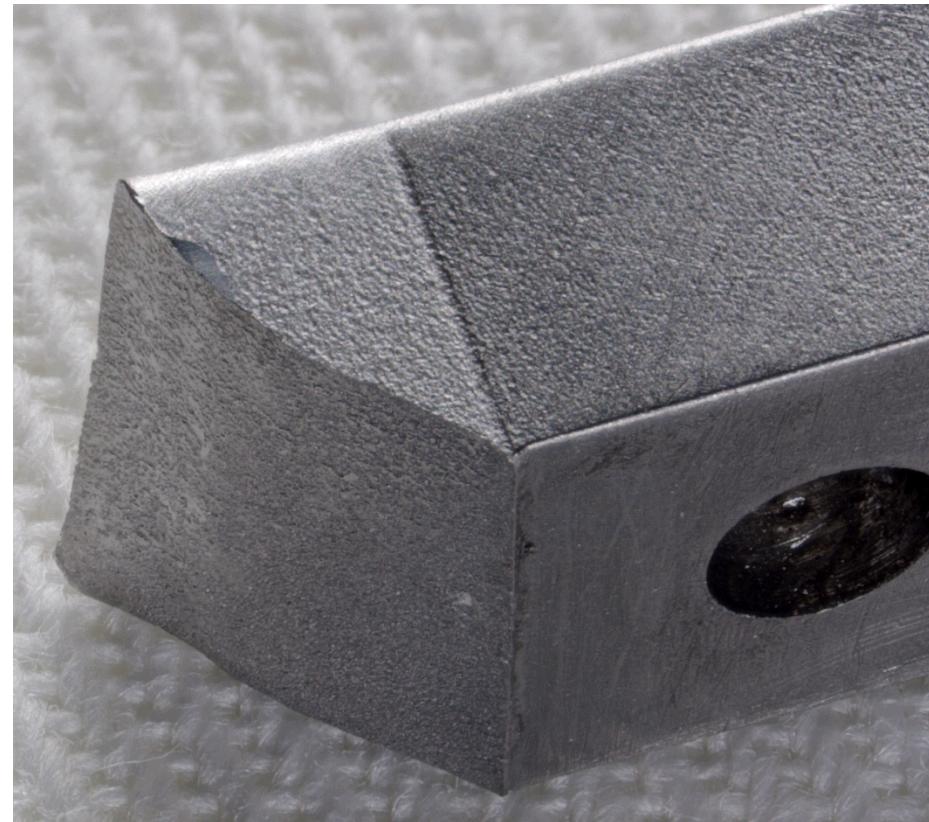


Material

E52100 Bearing Steel

Heat treated to Rockwell 59C-61C

- Very hard
- Not corrosion resistant
- Wear resistant



Equipment used for analysis

Keyence VHX2000 Digital Microscope

Lens 20-200



Carl Zeiss Supra™ 55VP SEM at 10 to 20kV

Working distance of 8.5 mm

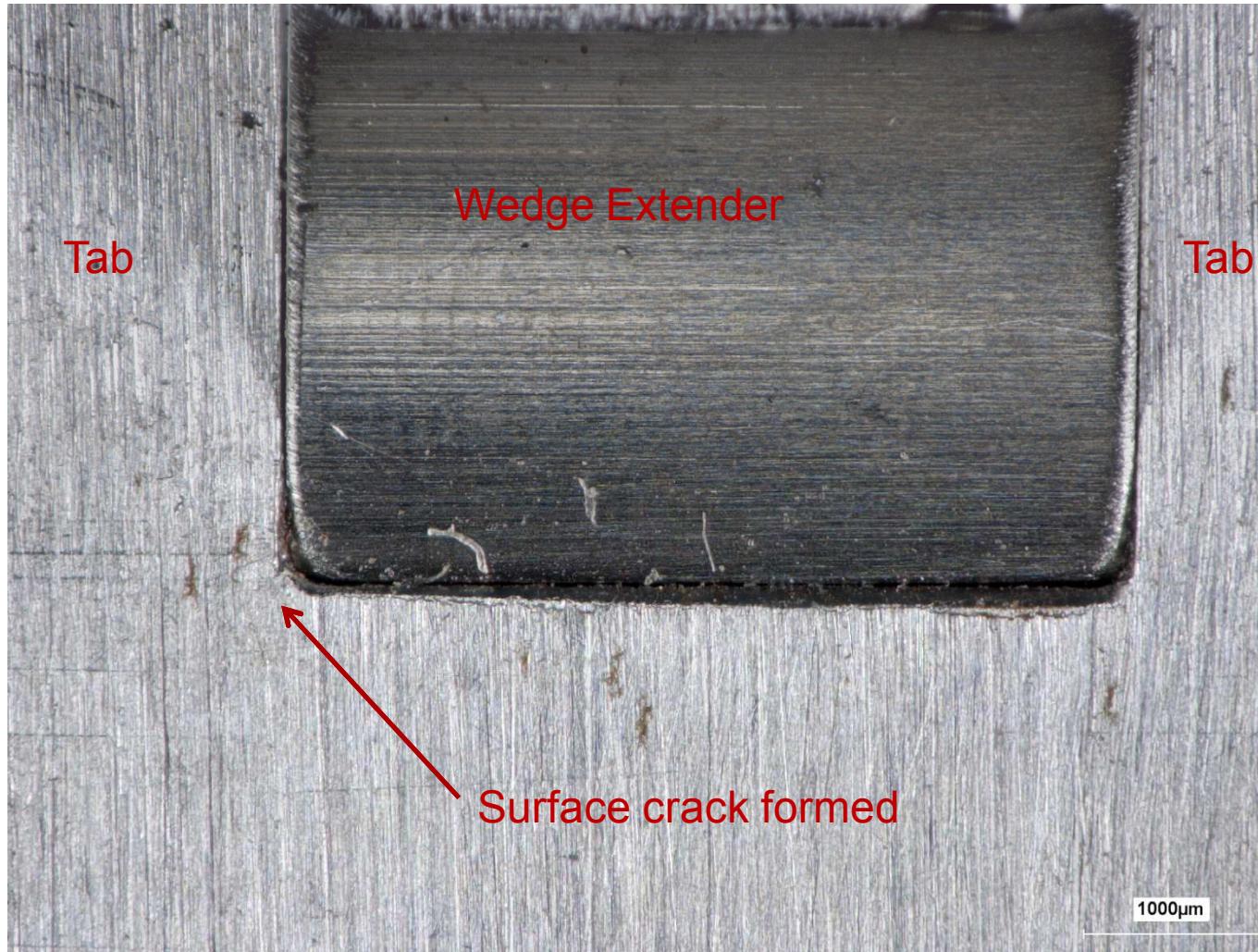
Varying degrees of magnification

Secondary (SE2) detection

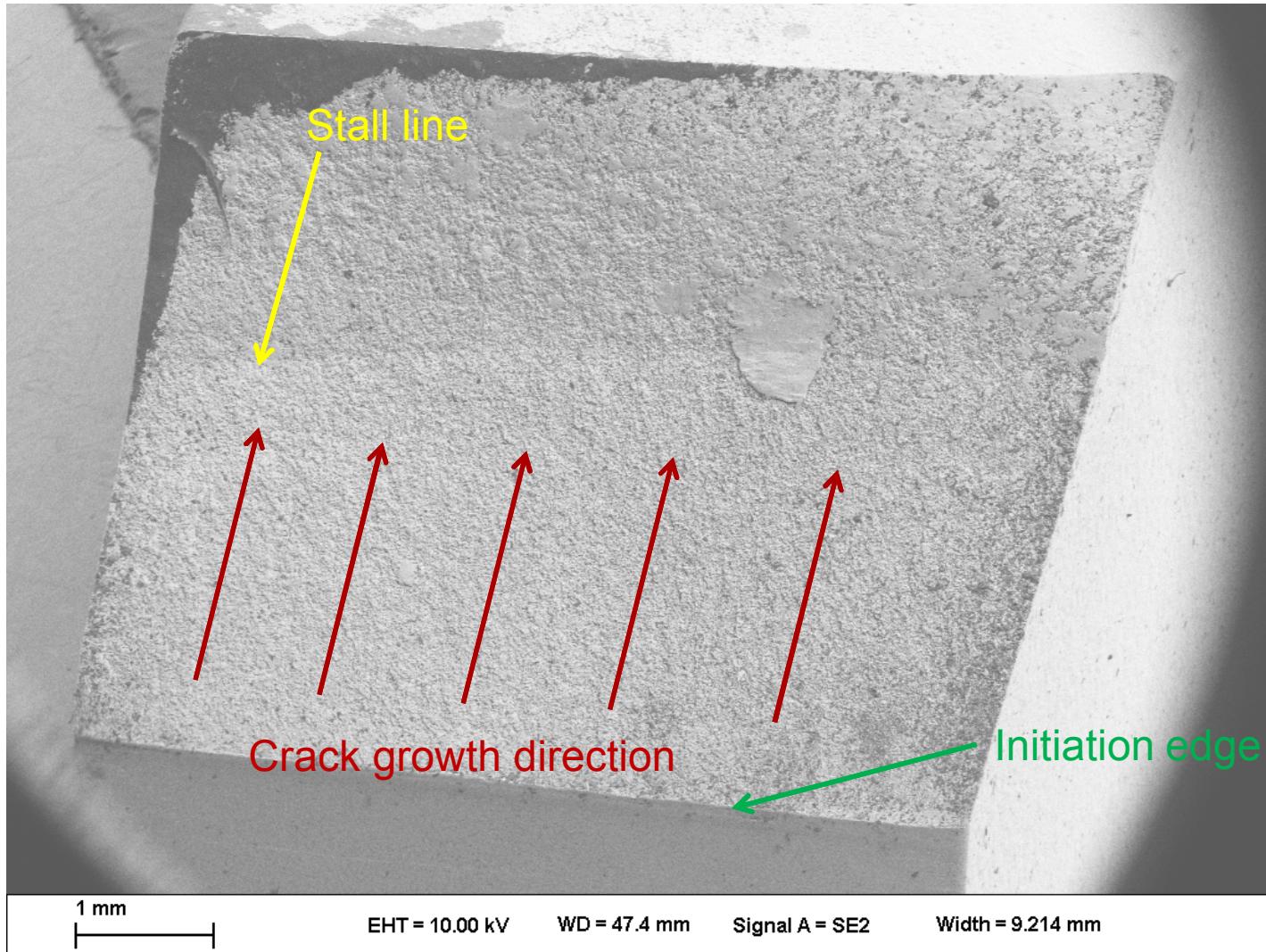


Pictures used from respective websites

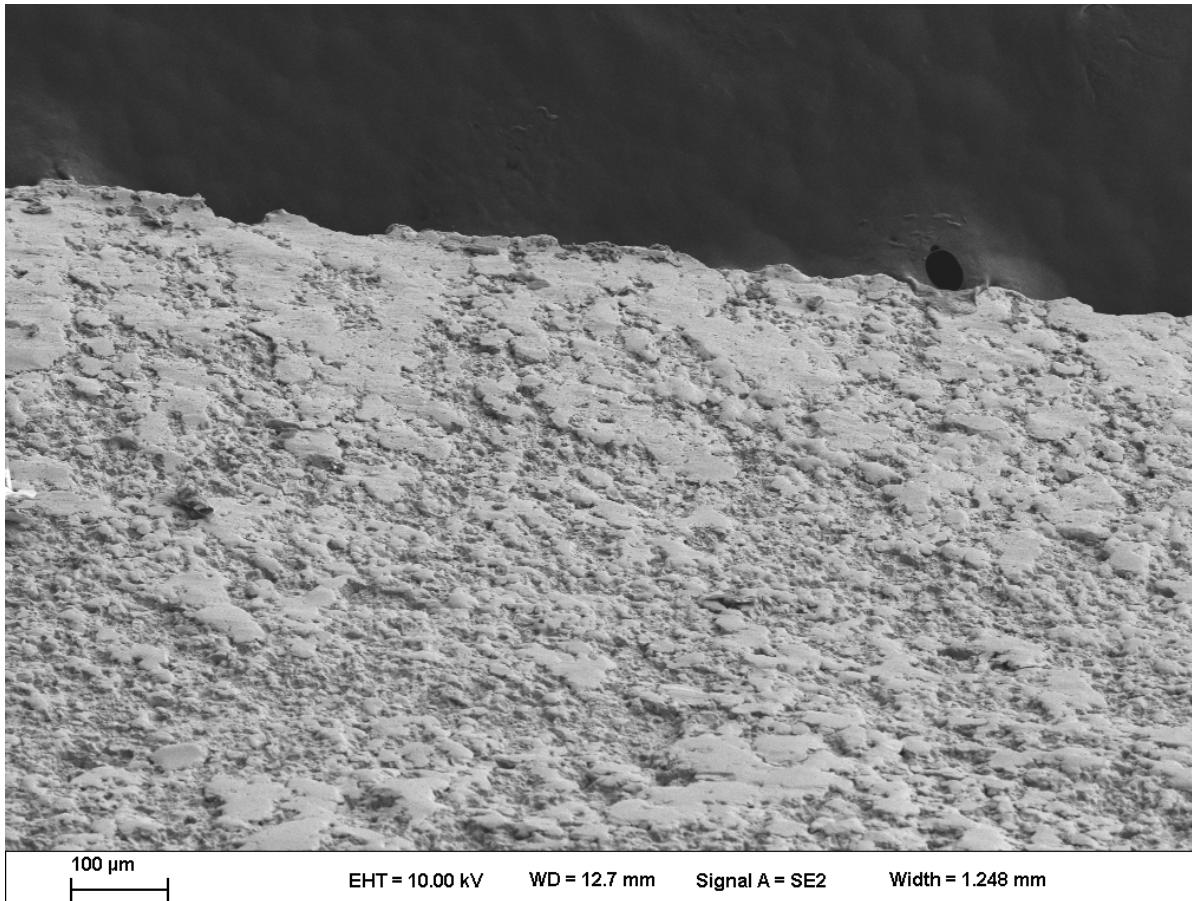
Surface Cracks forming



Results



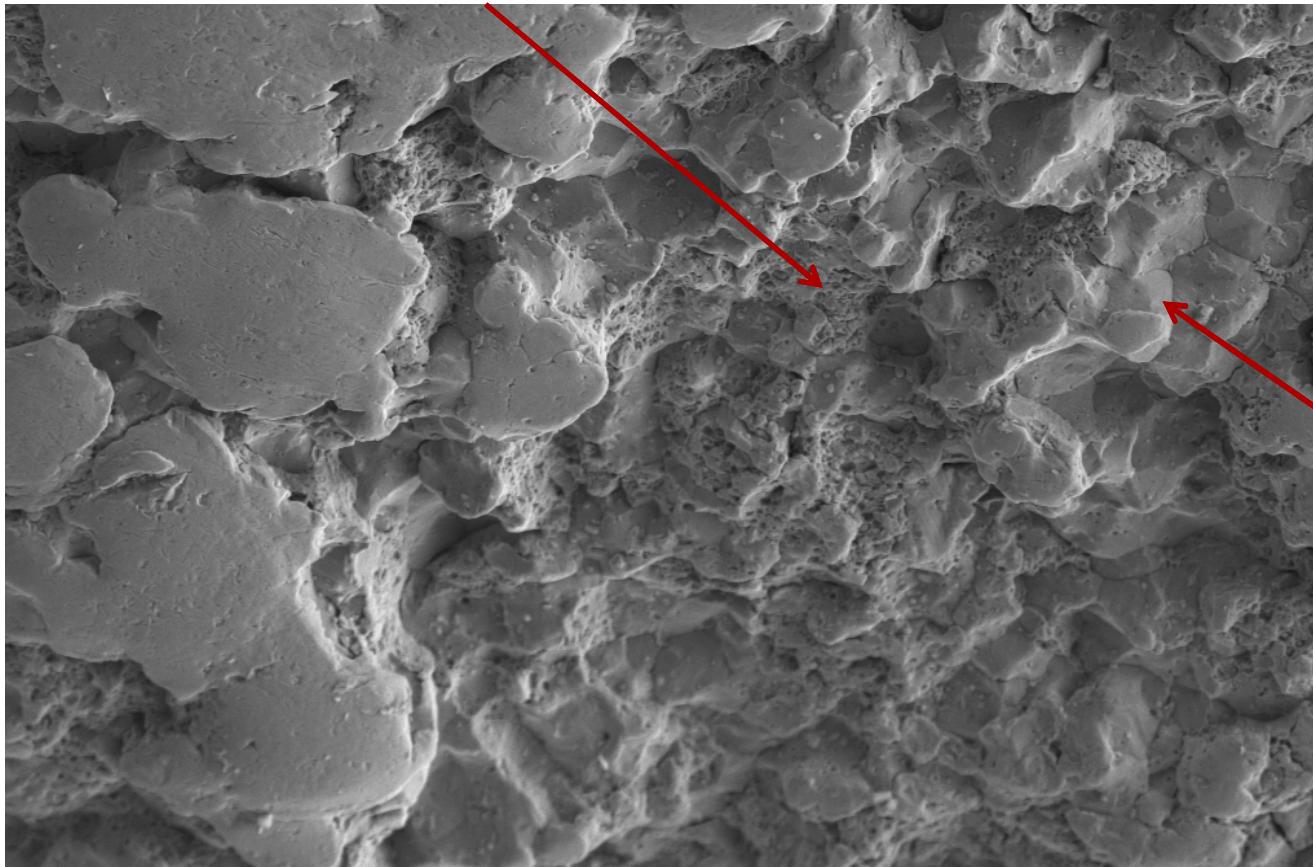
Fracture Face Damaged



- Fracture occurred early in service life
- Fracture surface severely hammered

Ductile fracture

Brittle fracture



20 μm

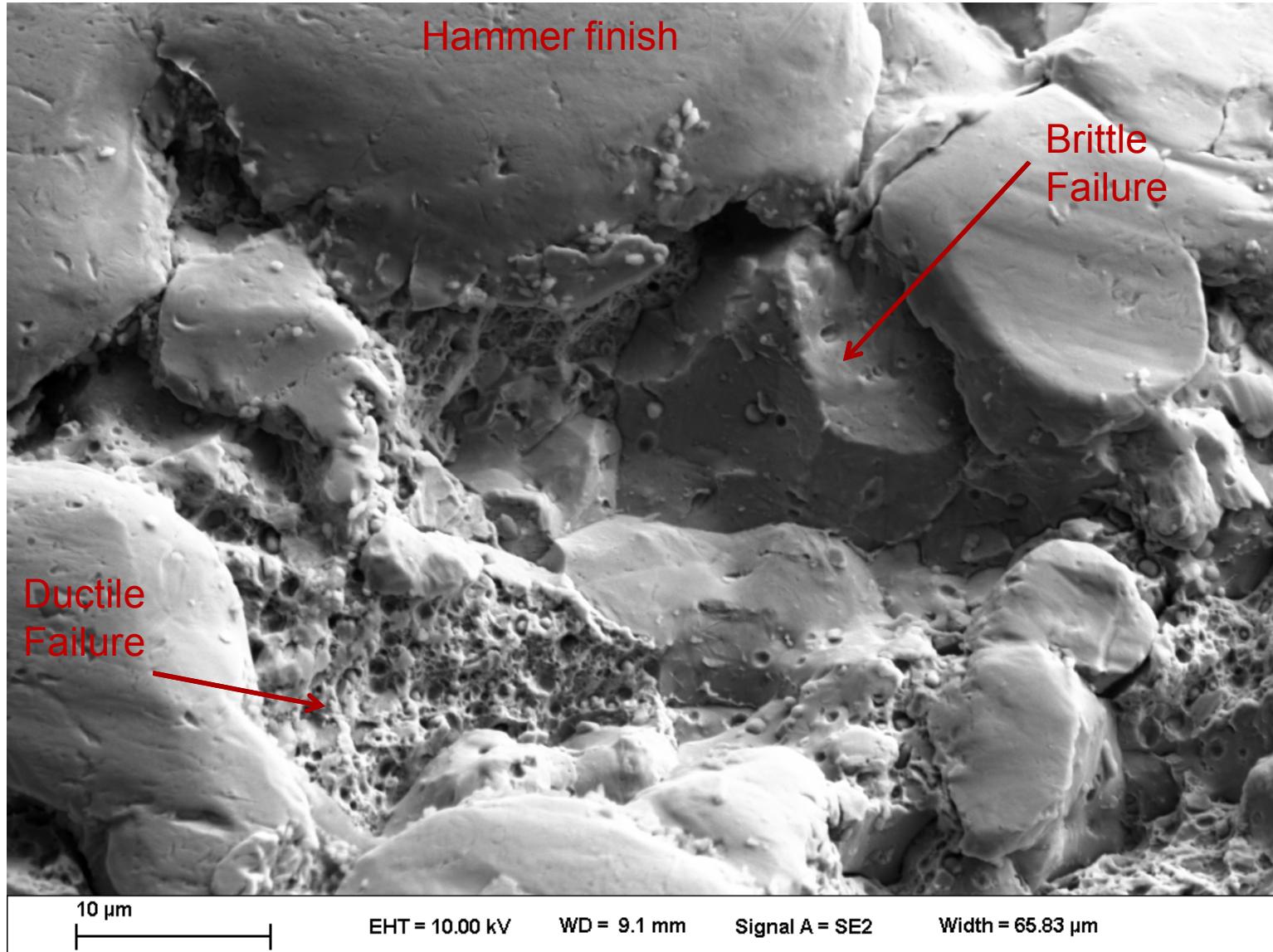


EHT = 10.00 kV

WD = 7.5 mm

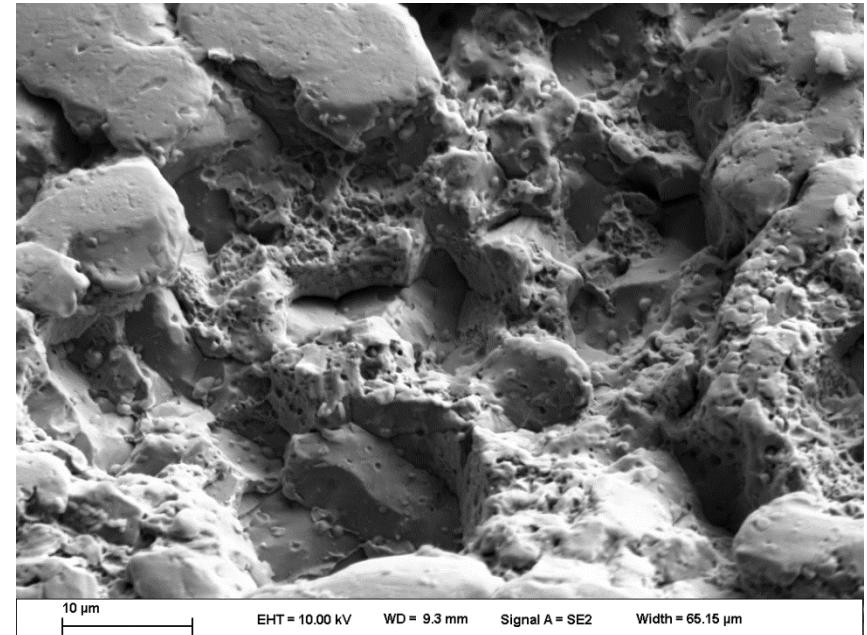
Signal A = SE2

Width = 152.8 μm



Conclusions

- Mixed-Mode Failure
- Hydrogen Embrittlement
- Temper Embrittlement



Recommendations

- Remove stress risers on the inside corners
- Relax tolerances on the press fit of the wedge extender into the wedge
- Change design, allow the wedge extender to have the tabs
- Address the water infiltration
- Address the HE and the Temper Embrittlement

Questions