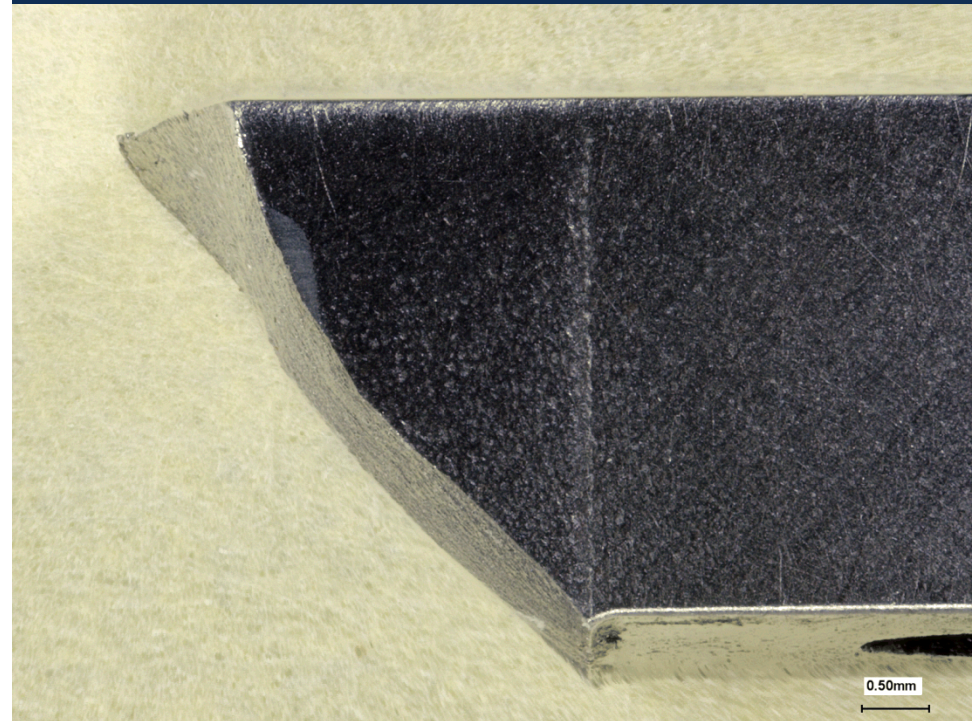


Wedge Assembly Failure Analysis

Kevin Jameson

April 23, 2014

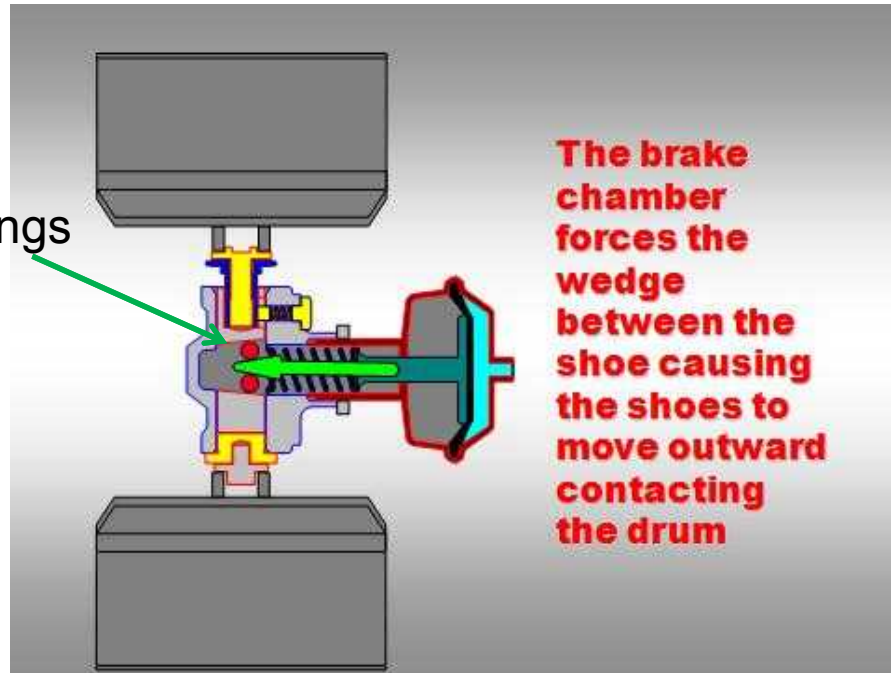
*Exceptional service
in the national interest*



Background

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

Wedge glides
along roller bearings

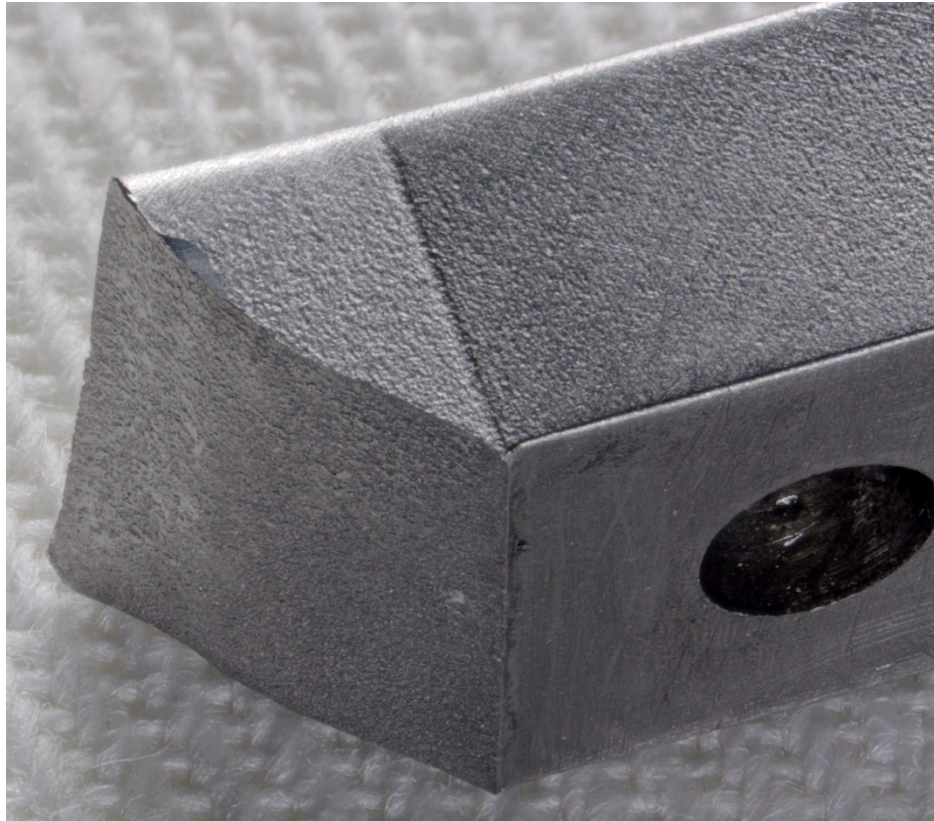


Material

E52100 Bearing Steel

Heat treated to Rockwell 59C-61C

- Very hard
- Not corrosion resistant
- Wear resistant



Equipment used for analysis

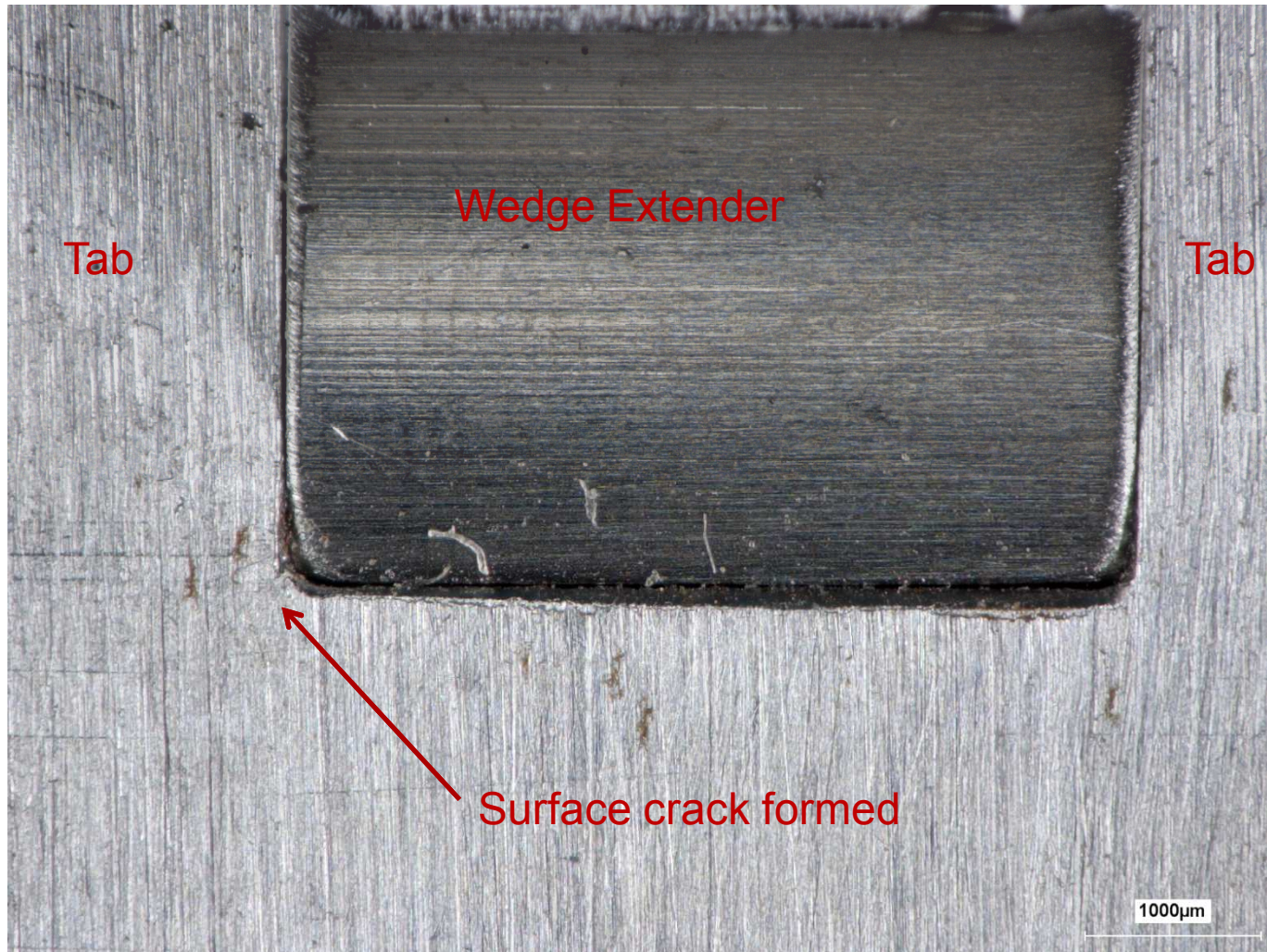
Keyence VHX2000 Digital Microscope
Lens 20-200

Carl Zeiss Supra™ 55VP SEM at 10 to 20kV
Working distance of 8.5 mm
Varying degrees of magnification
Secondary (SE2) detection

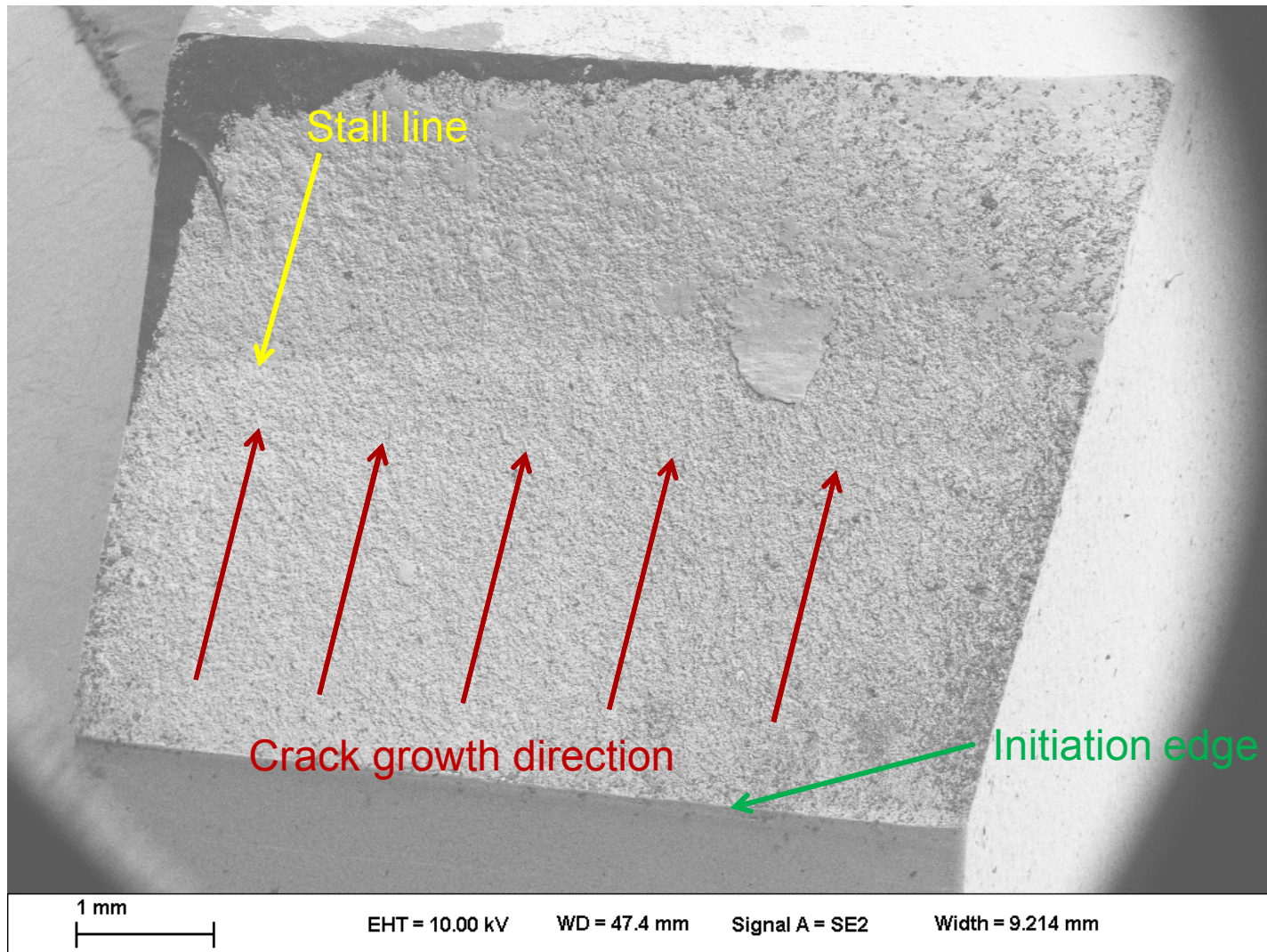


Pictures used from respective websites

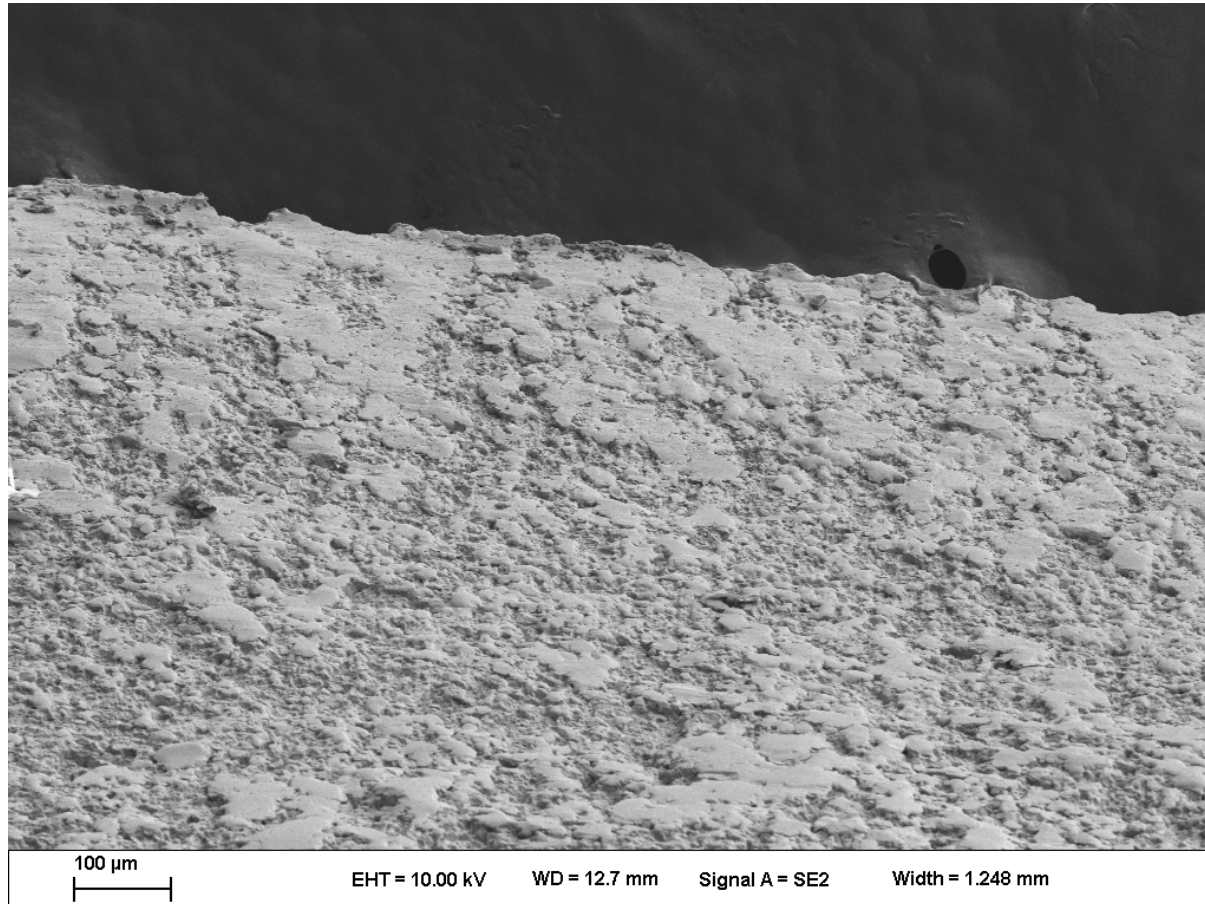
Surface Cracks forming



Results

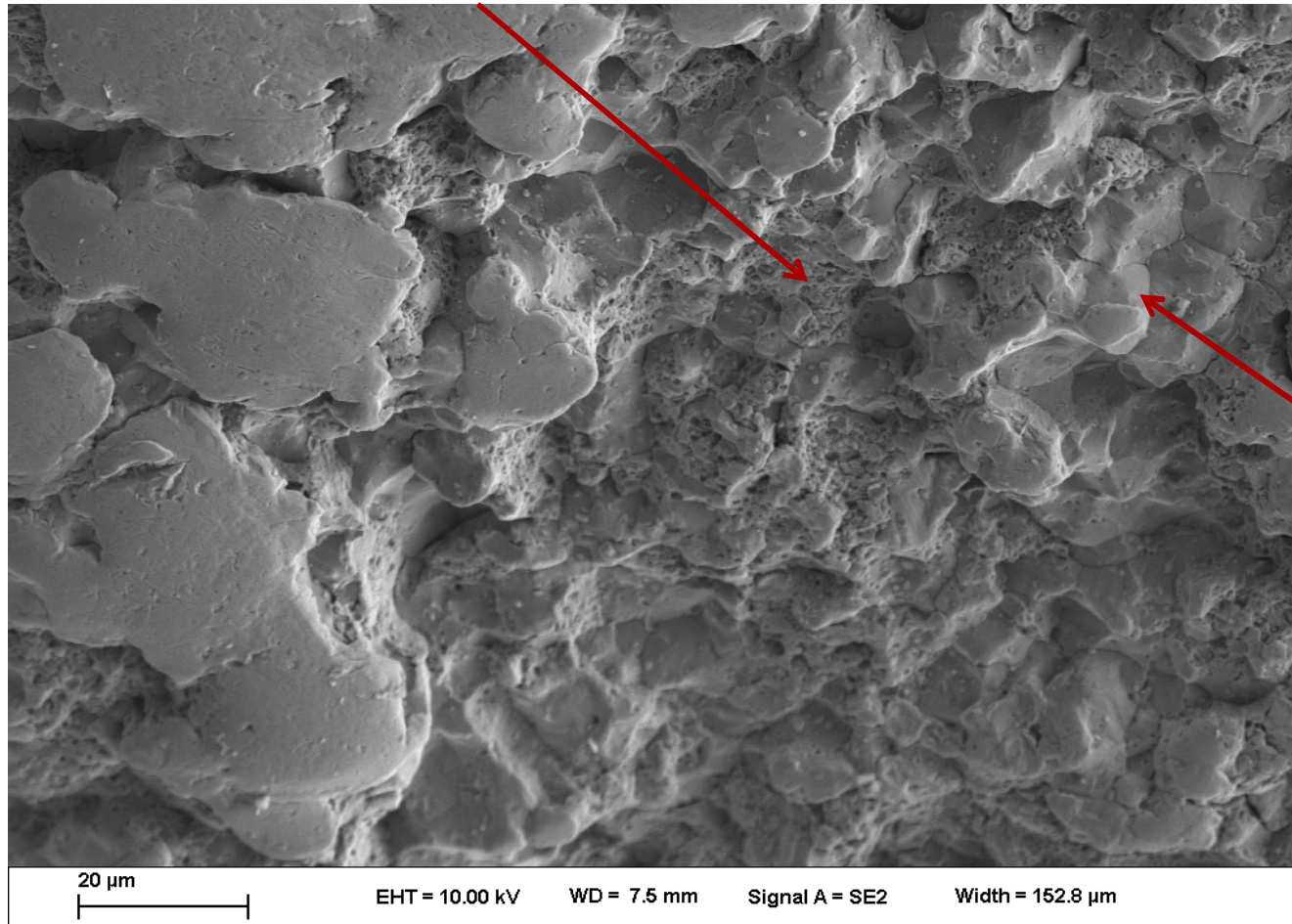


Fracture Face Damaged

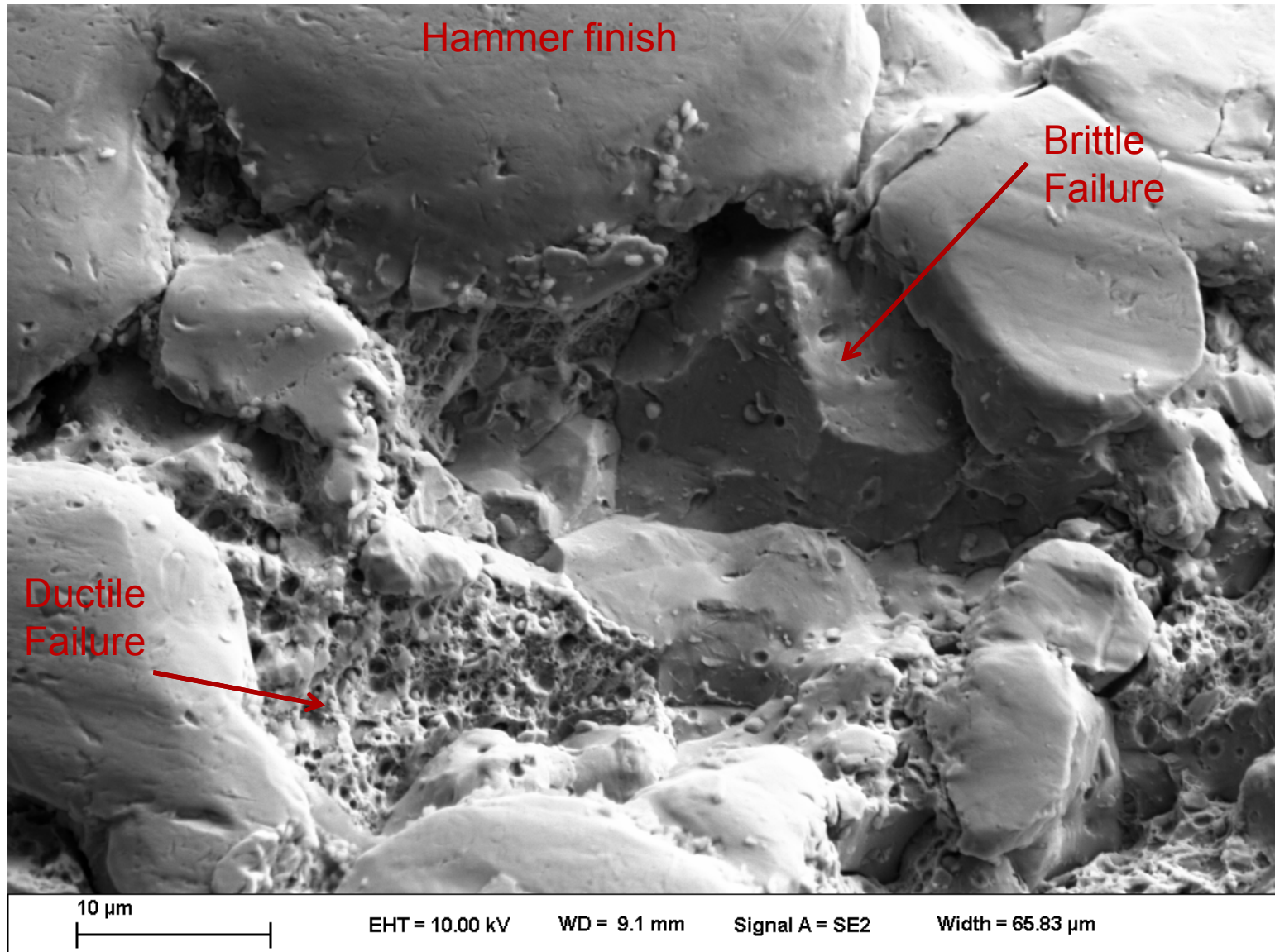


- Fracture occurred early in service life
- Fracture surface severely hammered

Ductile fracture

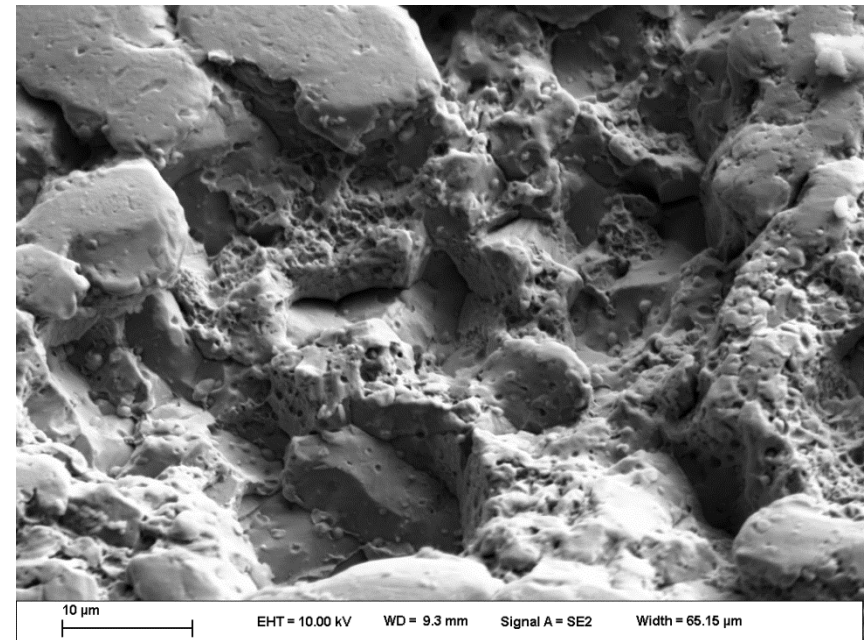


Brittle fracture



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