

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA25LA295

MATERIALS LABORATORY

Factual Report 25-078

November 25, 2025

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A. ACCIDENT INFORMATION

Location: Memphis, Tennessee
Date: August 8, 2025
Vehicle: Cessna 195 B, N1950C
Investigator: Todd Gunther, AS-ERA

B. COMPONENTS EXAMINED

Left Main Landing Gear Strut

C. EXAMINATION PARTICIPANTS

Specialist Daniel Crecco
National Transportation Safety Board
Washington, District of Columbia

D. DETAILS OF THE EXAMINATION

On August 8, 2025, a Cessna 195B, Tail: N1950C was substantially damaged upon landing at Memphis International Airport. No injuries were sustained by the two (2) people on board. Upon landing, the aircraft experienced a gear collapse and subsequently became disabled. Upon inspection, the left forward Main Landing Gear (MLG) strut was found fractured, with the liberated wheel assembly found adjacent to the aircraft, on the runway. Numbers "6L85(?)" were stamped on the outboard end of the spring.

As-received photo documentation was taken of the Spring, shown in **Figure 1**. The gear fractured approximately 6 inches away from the inboard end of the spring, seen in **Figure 2-Figure 3**. Surface regions around this area exhibited a rubbed appearance with missing paint. Some of these regions had exposed base metal with a reddish-brown oxidation (**Figure 4**). The majority of this damage was primarily sustained at the corners of the spring, both forward and aft. This damage was consistent with contact wear from the outboard supporting bracket.

The inboard fracture surface was photographed and visually examined, shown in **Figure 5**. The mating fracture surface on the outboard piece was largely corroded and damaged, and thus the examination focused on the inboard segment. The fracture featured curved surface micromorphology, transitioning from an orthogonal angle on the top surface of the spring towards a steeper curvature towards the bottom surface of the spring. Oblique lighting was used to reveal chevron and radial markings leading back to a thumbnail region on the forward upper corner of the landing gear. The thumbnail region spanned approximately 0.375 inches in the forward / aft direction and 0.100 inches in the through-thickness direction. Most of the fracture surface, excluding the thumbnail region, exhibited a dull gray

appearance and was rimmed with a small 45 degree shear lip, consistent with an overstress region and fast fracture. The thumbnail region exhibited a dark oxide that had numerous ratchet marks along the surface, progressing inward (**Figure 6**). A beachmark was observed around the curvilinear boundary of the region, consistent with a progressive crack (**Figure 7a**). The remainder of the fracture surface appeared to be moderately oxidized. The corresponding component surface adjacent to the fracture was devoid of paint and heavily corroded (**Figure 7b**).

The inboard segment of the main landing gear was sectioned approximately 1.5 inches away from and parallel with the fracture surface to facilitate electron microscope examination. The fracture segment was ultrasonically cleaned for 5 min in a solution of Alconox and water and subsequently rinsed in ethanol. The thumbnail region was further documented under a digital microscope as well as the damaged surface condition adjacent to the crack. Numerous ratchet marks, indicating the boundary between two propagating cracks, were observed along the initiation edge of the crack (**Figure 8**).

The surface of the component adjacent to the crack appeared oxidized with significant corrosion product buildup present. In regions where substrate material could be observed, grind marks angled at an approximately 15 degree angle from the transverse fracture surfaces were found (**Figure 9**). The manufacturing specification requirements deem transverse grinding marks as impermissible on edges and flats of the landing gear. While the profile of the primary crack was flat, several secondary crack initiation sites appeared to align closely along the angle of these grind marks (**Figure 10**).

The part was placed within a scanning electron microscope (SEM) to examine the fracture micromorphology. The majority of the dark thumbnail region exhibited a thick oxide that largely obscured underlying microfeatures. The dull region with the chevron marks that covered the majority of the fracture surface exhibited a dimple structure, consistent with overstress fast fracture.

The fracture surface was further sectioned down to facilitate SEM examination. Acetate replication films were used to remove oxides on the fracture surface and adjacent surfaces, followed by ultrasonic cleaning in an acetone bath.

Further SEM examination found the fracture surface in the thumbnail region was still largely corroded and damaged, exhibiting pancaking and compressive damage. This was consistent with loading of the top surface of the MLG in compression during landing and ground load bearing activities. However, near the crack tip boundary two bands of a feathery progressive fracture region were observed, consistent with fatigue in martensitic steels (**Figure 11**). Progressive tearing and secondary cracks were observed suggesting a high propagation rate. These bands were observed across the entire crack tip on both cracks, and exhibited

minimal corrosion damage, consistent with formation during cycles not long before final overstress.

Much of the initiation region of the fracture was degraded by post-fracture damage and corrosion. However, several pits and pockets of intergranular attack (IGA) were observed, characterized by a rock-candy appearance and secondary cracking (**Figure 12**). Much of the surfaces surrounding the area exhibited evidence of corrosion and grinding damage.

SEM examination of the component surface adjacent to the initiation site after oxide removal revealed both significant pitting damage and grind marks (**Figure 13**). Along the crack profile edge, severe corrosion appeared to have led to a significant amount of material loss from the surface of the part. In some places the corrosion appeared to have attacked along the pre-existing grind marks, while other locations pitting had formed large cavities in the material. At the secondary crack locations, the profile appeared to align with the angularity of the grinding marks, suggesting influence from the surface damage (**Figure 14**). However, significant pitting was still present on these surfaces as well.

In a region away from the worn crack initiation area, a segment of paint was flaked off and removed in the laboratory setting, revealing the bare metal substrate unaffected by the heavy oxidation (**Figure 15**). However, a texture was observed across this area that was partially obscured by islands of smeared metal, similar to the grinding marks observed adjacent to the crack. Material was observed smearing over many of these cavities-like features, suggesting they were present prior to the grinding operation. Additionally, what appeared to be primer material was observed in many of these cavities, suggesting that they were present at the time of the most recent coating of the part (**Figure 16**). It is to note that surface grinding is not permitted at any time after final media blasting of the landing gear.

An Additional cross-sectional slice was taken from the inboard MLG piece approximately 0.5 inches parallel away from previous cut. Eleven (11) Rockwell C scale (HRC) hardness indents were taken across the width and length of the MLG cross-section using a Wilson Rockwell 2000 Hardness Tester, in accordance with ASTM E18. Material hardness met manufacturer requirements and no localized variations in values were observed across the profile of the strut.

X-ray fluorescence (XRF) was used to verify composition of the substrate material using an Olympus Vanta C-series handheld XRF. No compositional discrepancies with the manufacturing specifications were noted.

Submitted by:

Daniel Crecco
Materials Engineer



Figure 1. As-received photographs of the Cessna 195B left MLG Leg.

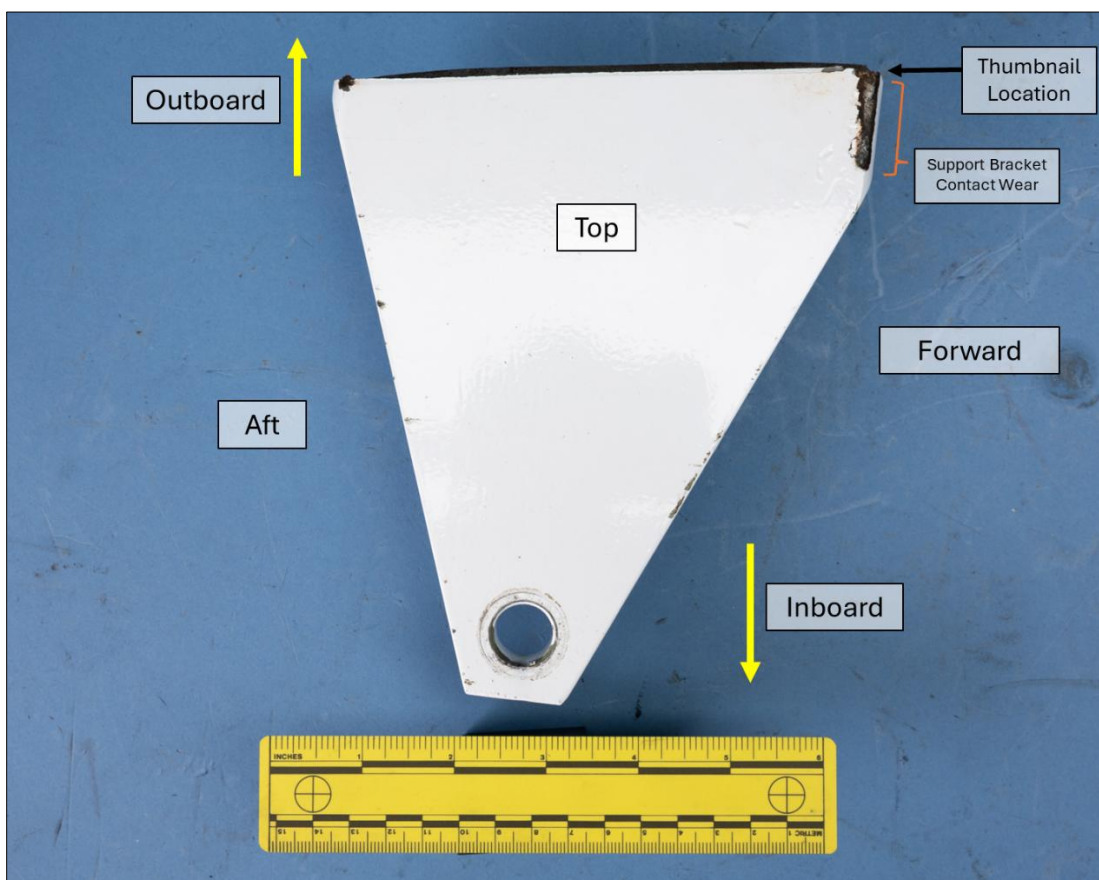


Figure 2. As-received photograph of the top surface of the inboard fracture segment.

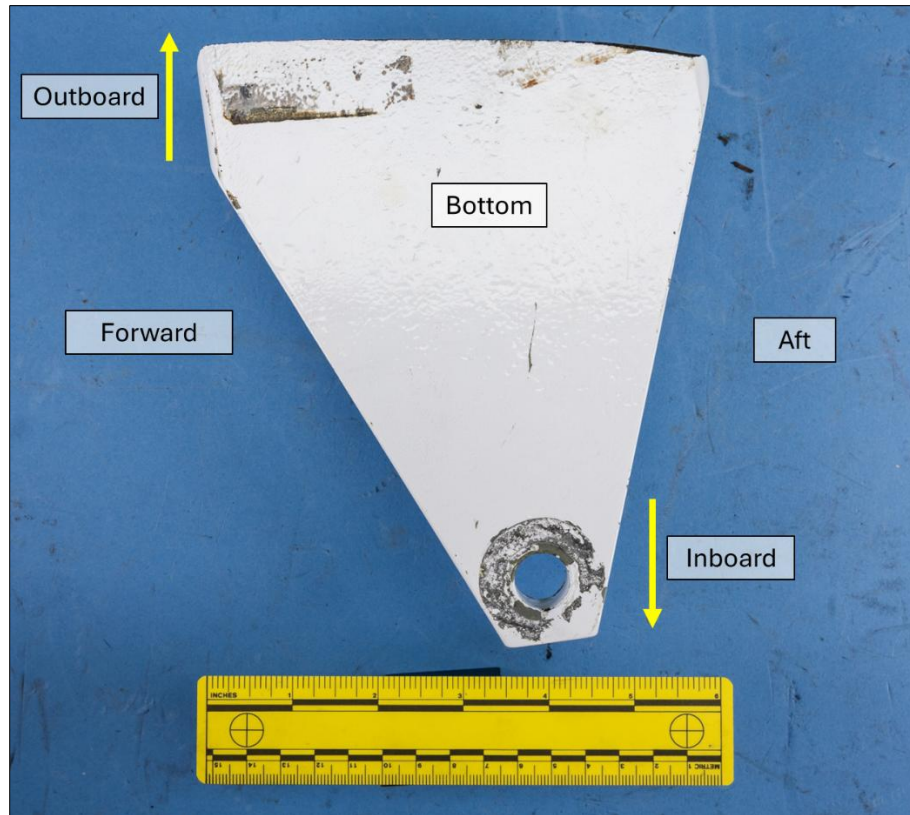


Figure 3. As-received photograph of the bottom surface of the inboard fracture segment.

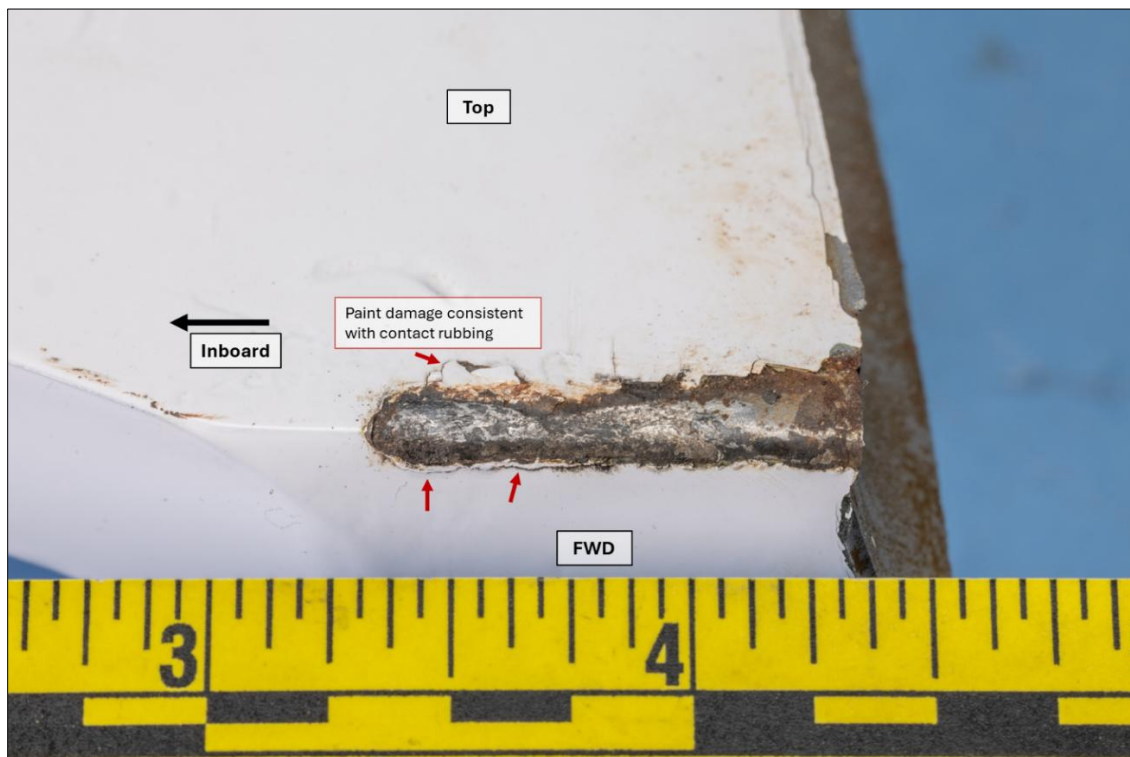


Figure 4. As-received photograph of the wear region adjacent to the thumbnail crack.

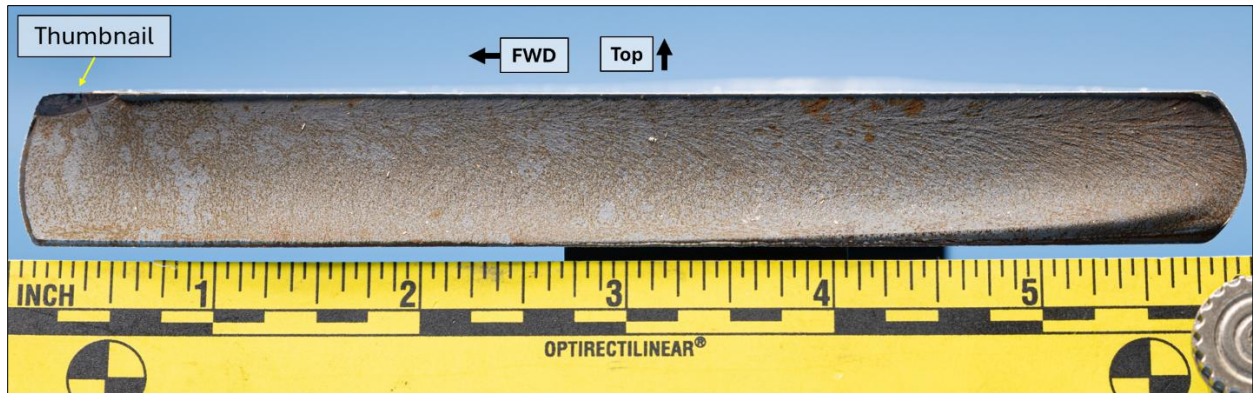


Figure 5. As-received photograph of the fracture surface using oblique lighting to highlight the chevron and radial marks pointing back to the thumbnail.



Figure 6. As-received photograph at an oblique angle of the thumbnail crack and wear surface.



Figure 7. Digital microscopic images of the thumbnail crack a) top down highlighting the region and beachmark at the crack tip, and b) oblique angle to show adjacent component surface.

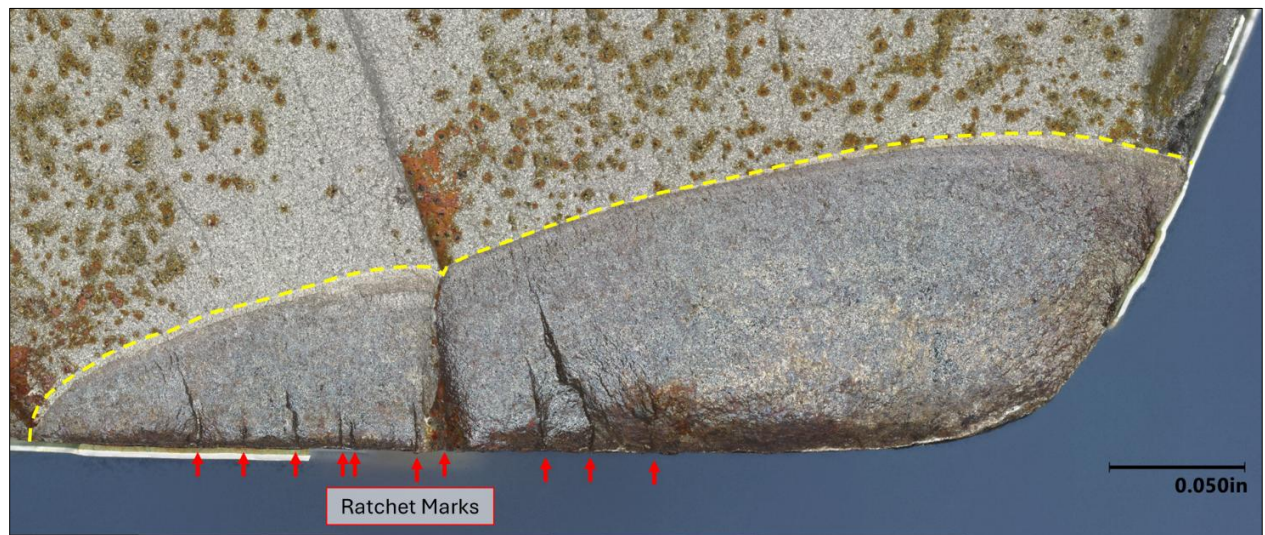


Figure 8. Digital microscopic images of the thumbnail crack with a yellow dashed line denoting the crack tip boundary line and red arrows identifying ratchet marks.

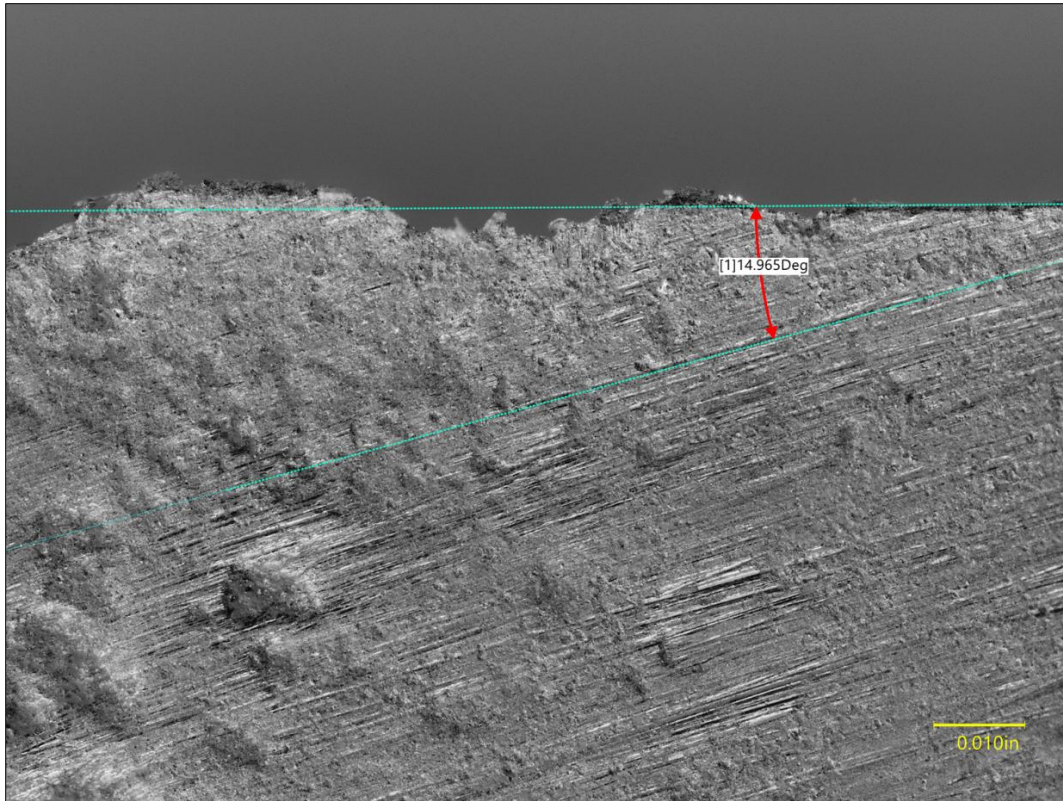


Figure 9. Digital microscopic monochrome image of the gear leg upper surface adjacent to the fracture, with oblique lighting textural enhancement for measuring purposes.

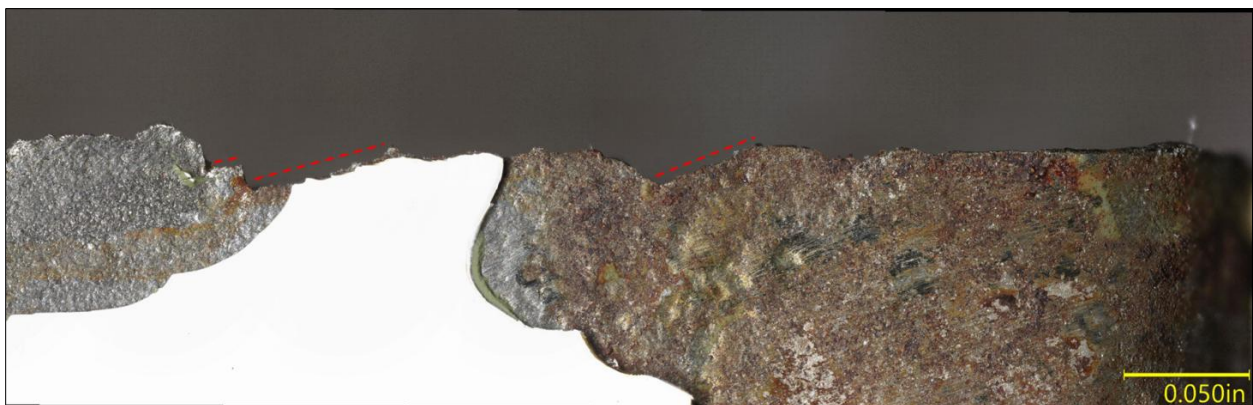


Figure 10. Digital microscopic montage of the gear leg upper surface adjacent to the fracture (also see figure 7b). Regions along the fracture profile with red dashed lines identify secondary initiations exhibiting a similar angle as the observed grind marks shown in Figure 9.

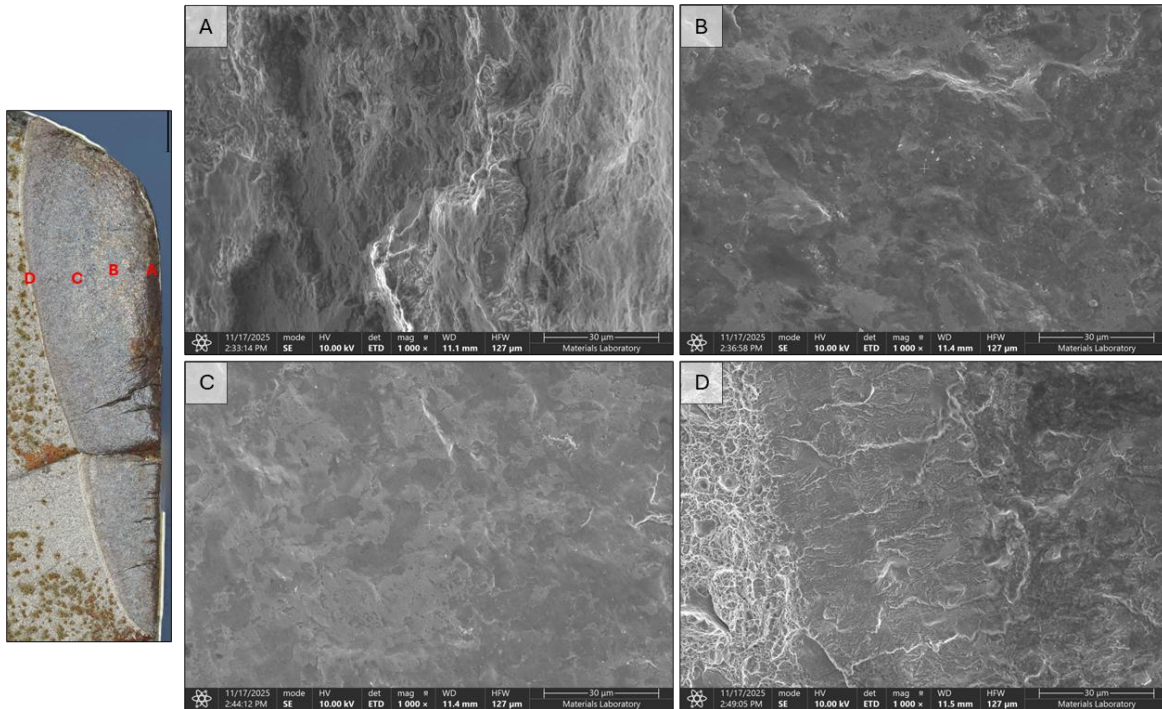


Figure 11. Scanning electron microscopic images of the progressive fracture progression. At Site D, two bands of feathery fracture were observed prior to final overload.

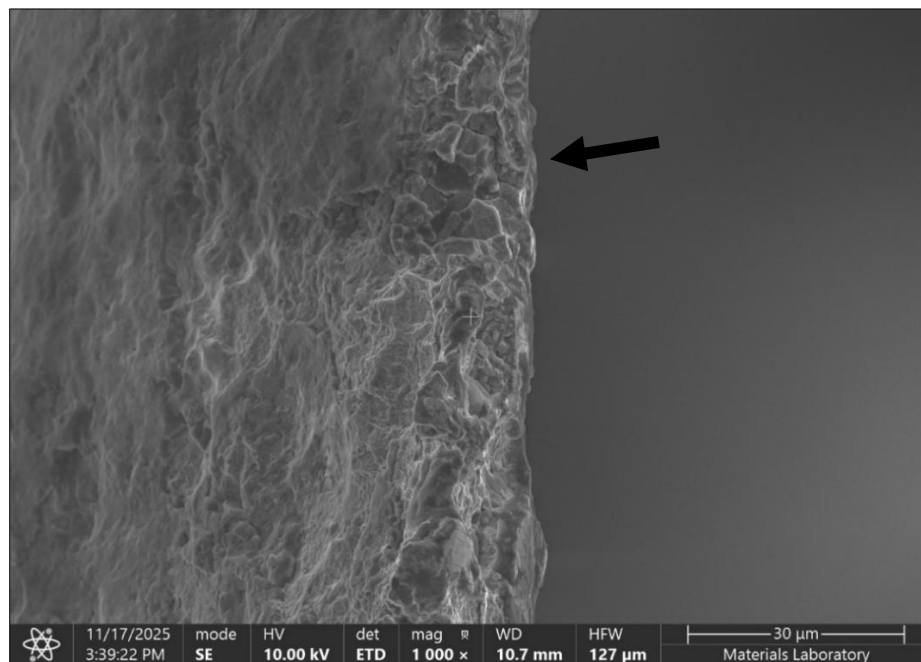


Figure 12. Scanning electron microscopic images of the initiation site, exhibiting corrosion and intergranular attack (IGA), highlighted by the arrow.

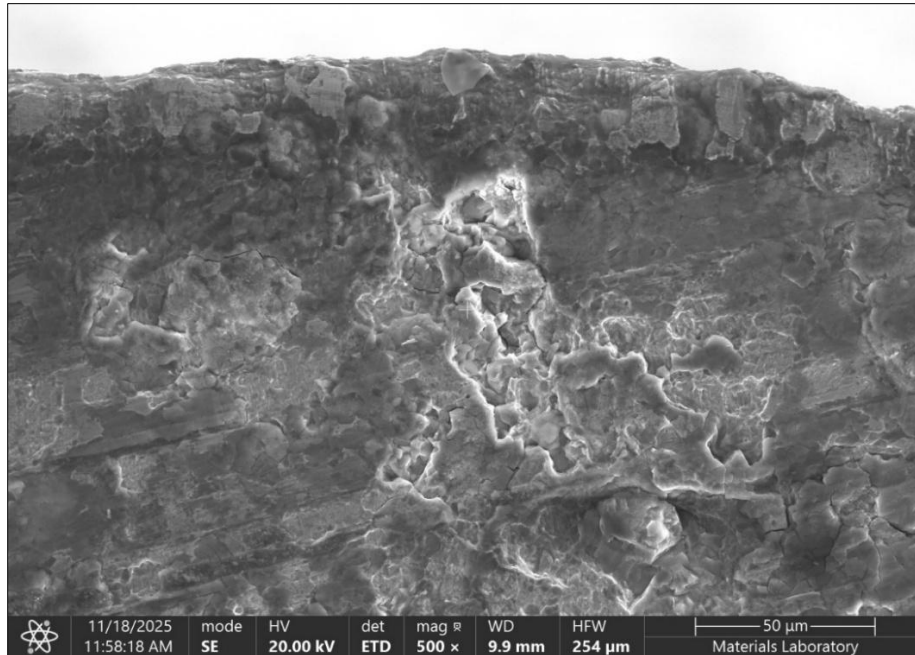


Figure 13. Scanning electron microscopic images of the component surface adjacent to the initiation site, exhibiting pitting and corrosion damage. Grind marks can be observed at an approximate 15-degree angle, however are partially obscured by the corrosion.

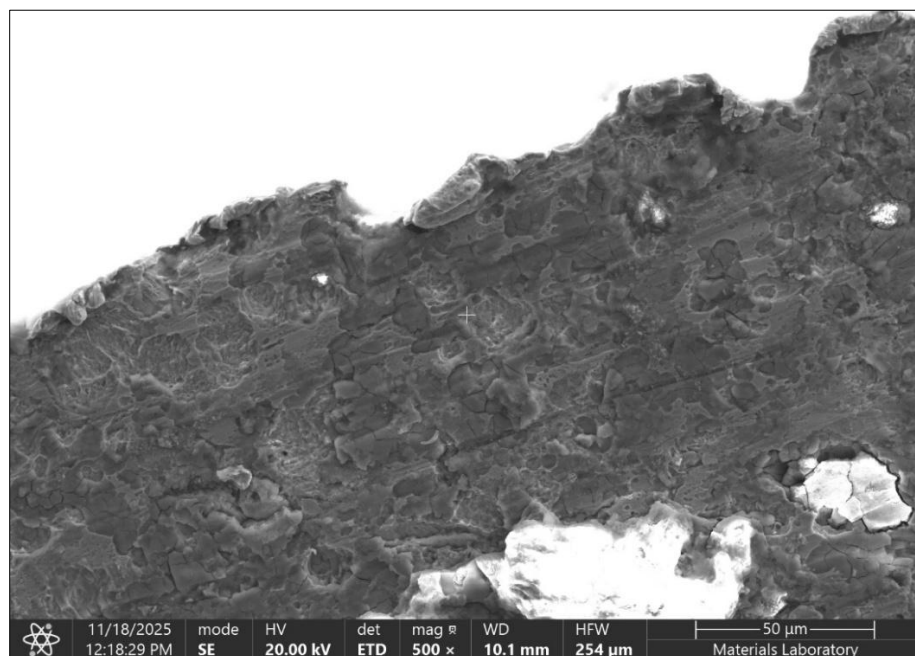


Figure 14. Scanning electron microscopic images of the surface adjacent to a secondary initiation site, exhibiting a similar angle to the grind marks, as well as pitting corrosion.

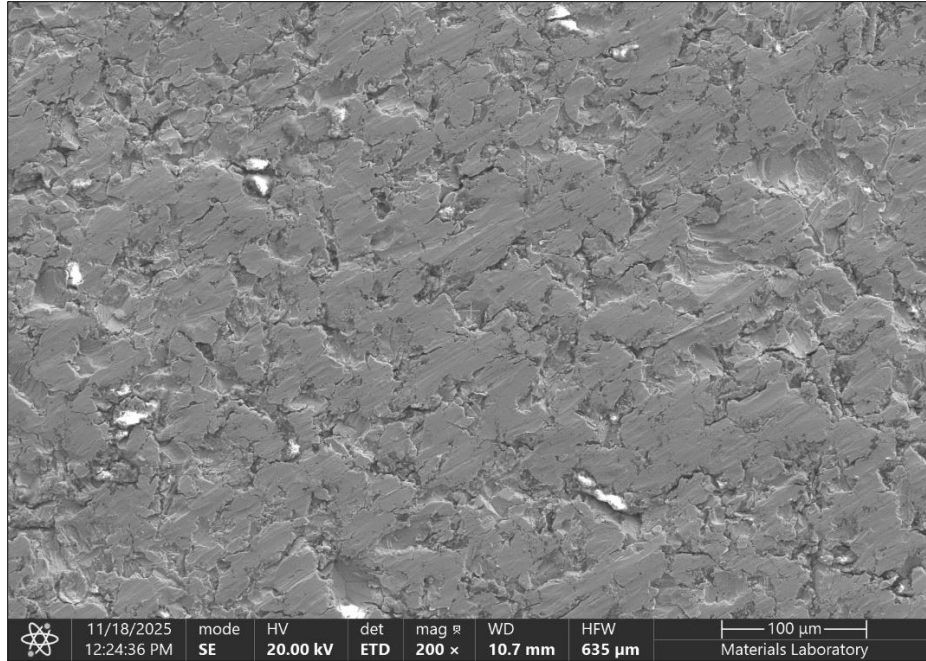


Figure 15. Scanning electron microscopic images of an area away from the crack and worn region, exhibiting a pit-like texturing partially ground away by similarly angled grind marks.



Figure 16. Digital microscopic image of an area away from the crack and worn region, exhibiting pit-like texturing. Remnant primer material can be observed in the cavities of the surface, suggesting the pits were present at time of primer application.