

Figure 4. Cylinder fragment 2A-1.  
(a) Sections cut. Mech denotes the piece used for machining tensile test coupons.  
Photo ID: DC17916-R12E1.  
(b) Tensile test coupons in the post-tested condition.  
Photo ID: DC17916-R11E21.





Figure 5. Sectioning of fragments 2A-2 and 2A-4.

Photo ID: DC17916-R4E6.

Note: FS denotes the wafer containing a portion of the flat-faced fracture surface, MET denotes the wafer cut below the FS wafer and used for metallographic examination, and HT denotes the section used for Rockwell hardness measurements.



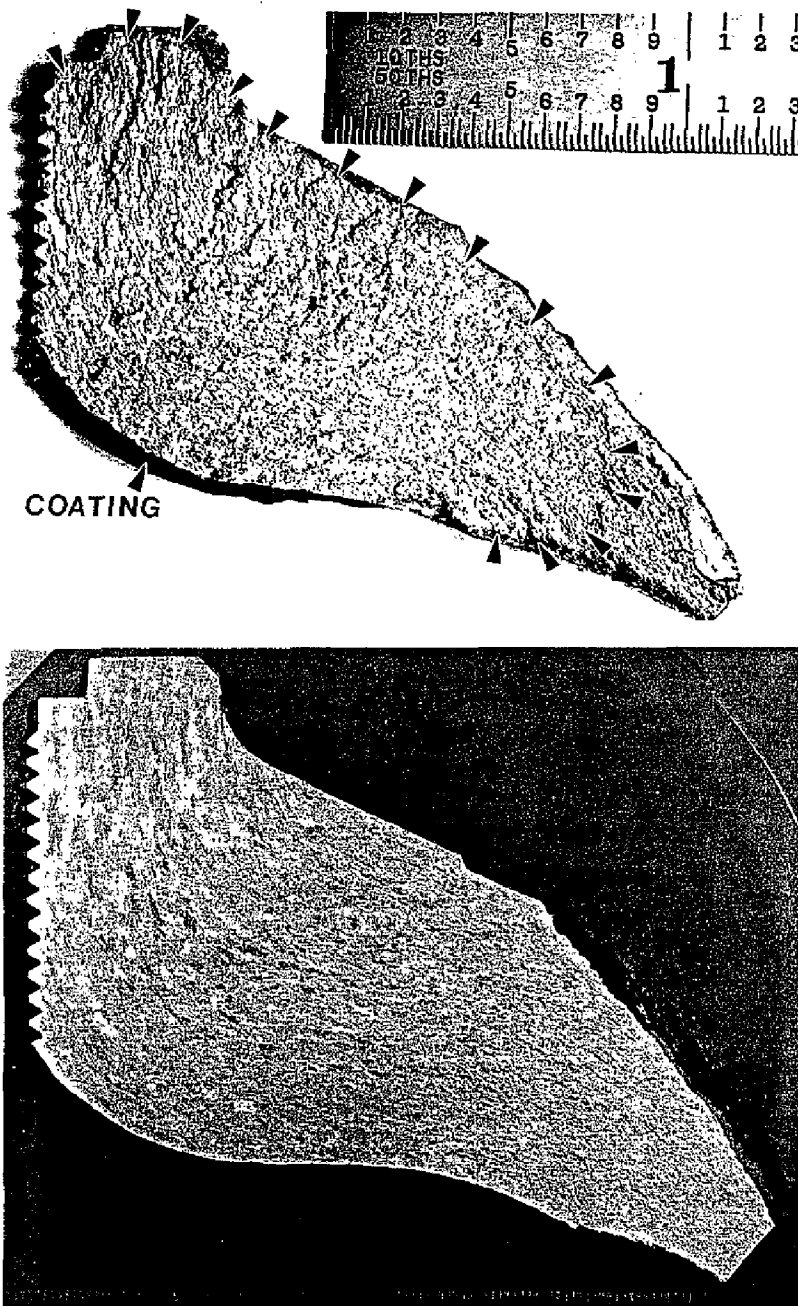


Figure 6. Wafers FS and MET from Figure 5.  
 (a) Portion of flat-faced fracture surface from neck region of fragment 2A-1. Photo ID: DC17916-TRS-1-01/14/97.  
 (b) Macrostructure of neck region of fragment 2A-1. HF/H<sub>2</sub>SO<sub>4</sub>/H<sub>2</sub>O etch. Photo ID:DC17916-PAL-1-10/31/96. Scale is in 0.02 inch increments.

Note: Inside cylinder coating on the fracture surface as shown. Unlabeled arrows define an apparent beach mark on the fracture surface.



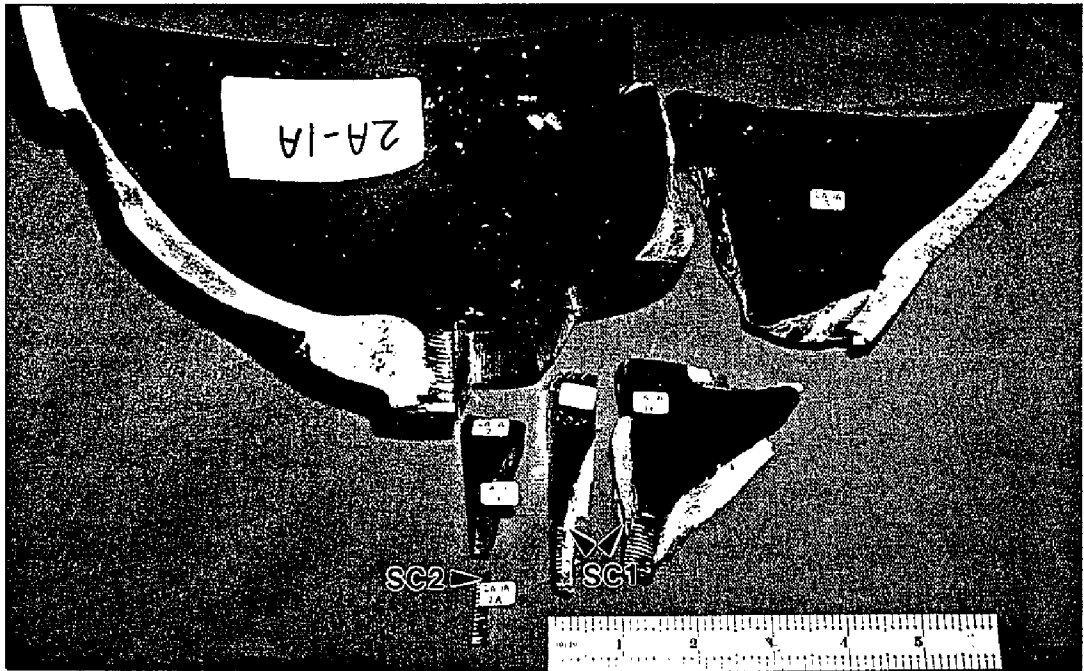


Figure 7. Sectioning of fragment 2A-1 in the neck region.  
Photo ID: DC17916-R11E2.  
Note: The crack SC1 (see Figure 3) forced open in the laboratory and the crack SC2 contained within the sections 2A-1A2A and 2A-1A2B.



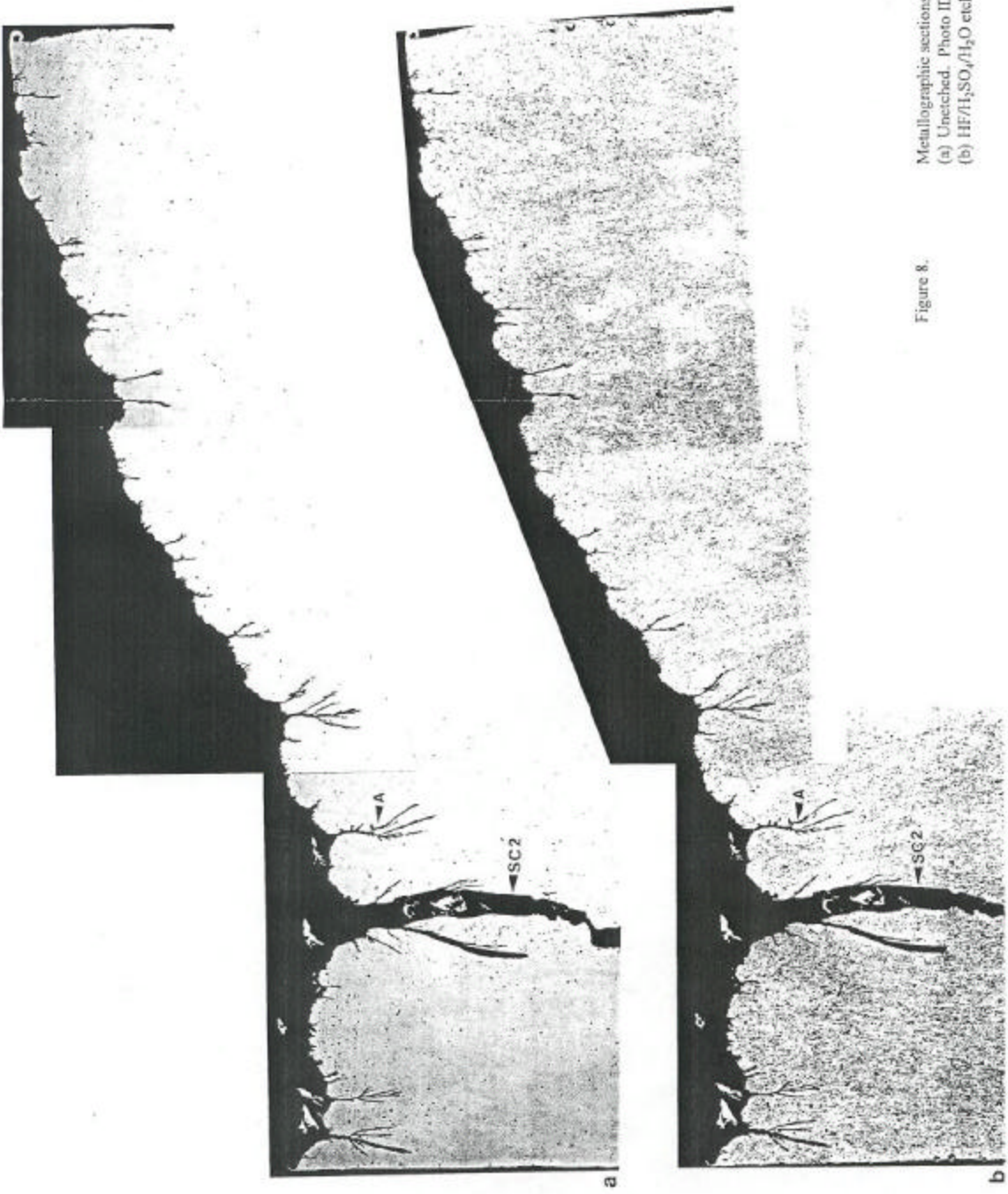


Figure 8. Metallographic sections of 2A-1A2B containing SC2. 50X.  
(a) Unetched. Photo ID: DC17916-PAL-1.2.3-11/08/96.  
(b) HF/H<sub>2</sub>SO<sub>4</sub>/H<sub>2</sub>O etch. Photo ID: DC17916-PAL-4.5.6-11/08/96.

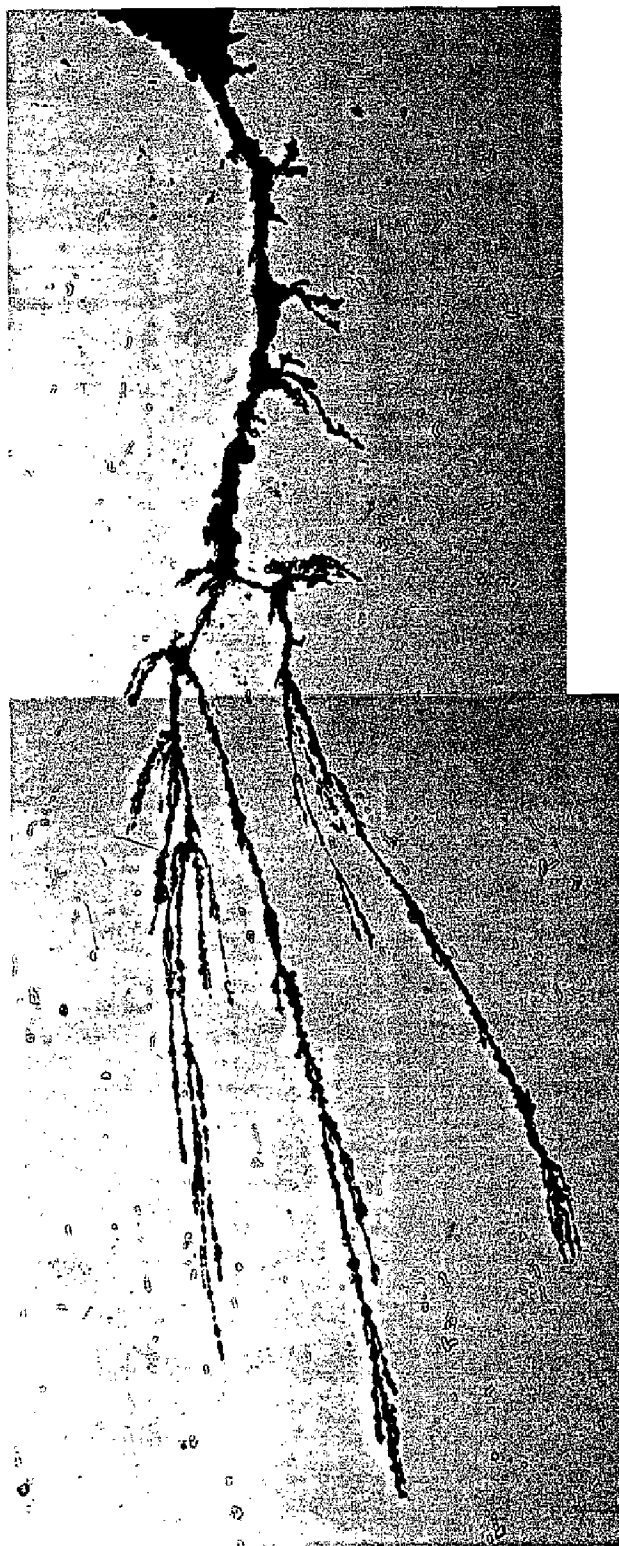


Figure 9. Close-up of crack "A" from Figure 8. 400X.  
Unetched. Photo ID: DC17916-PAL-9,10-11/08/96.





(a)



(b)

Figure 10. A crack tip from Figure 8.

(a) Tip region. 50X. Unetched.

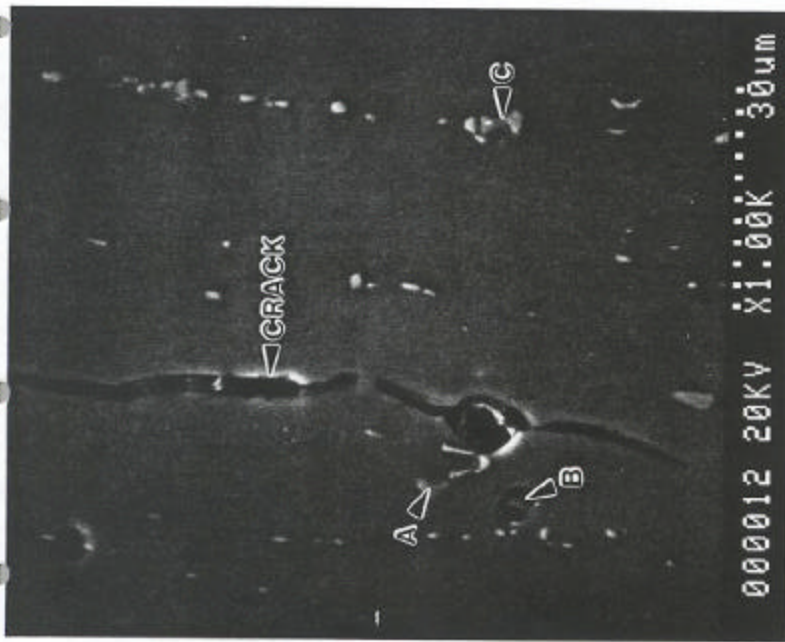
Photo ID: DC17916-PAL-7-11/08/96

(b) Detail of tip. 500X.. Unetched.

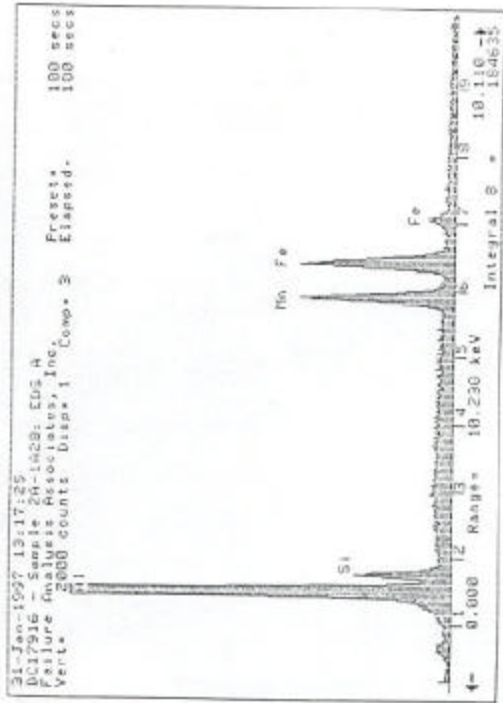
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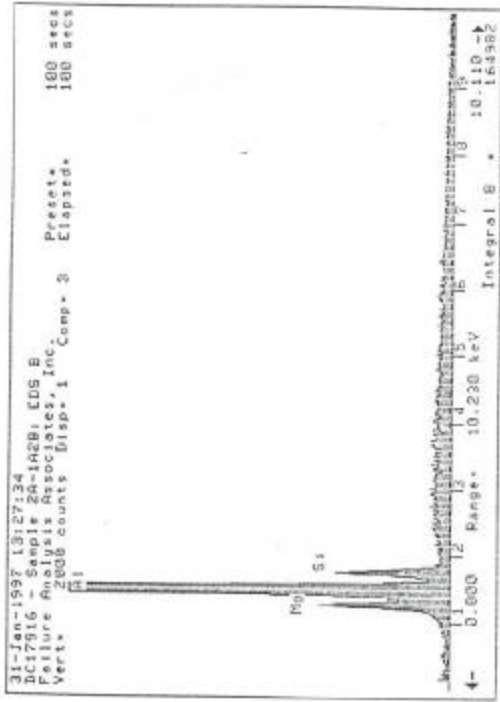




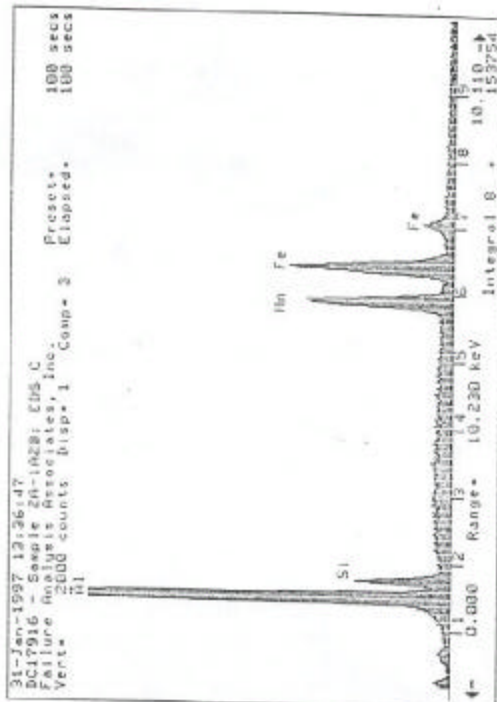
a



b



c



d

Figure 11. Precipitates near a crack tip.  
 Photo ID: DC17916-PAL-12-01/31/97  
 (a) SEM micrograph of a crack tip.  
 (b) EDS spectrum of inclusion A.  
 (c) EDS spectrum of inclusion B.  
 (d) EDS spectrum of inclusion C.





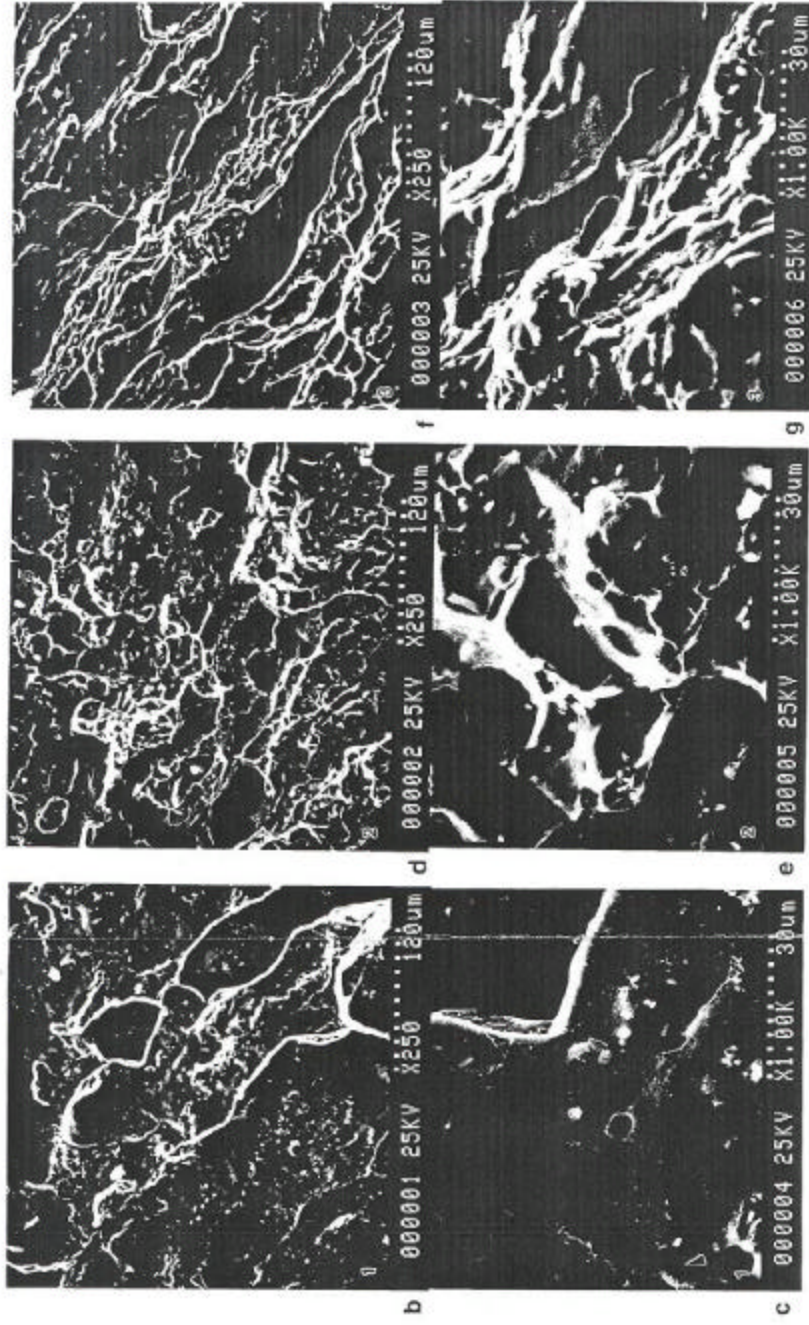
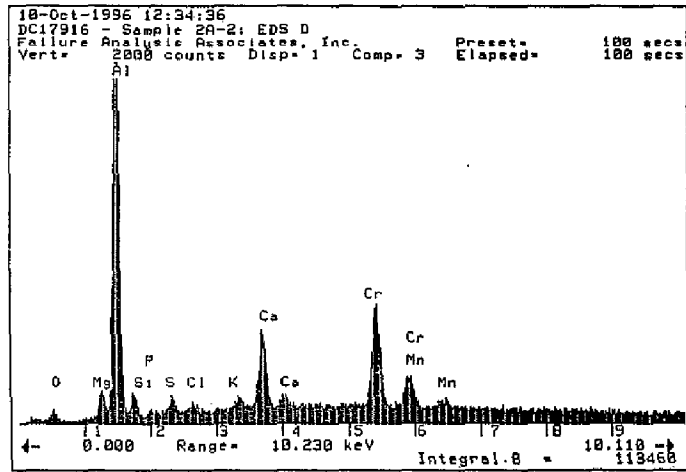
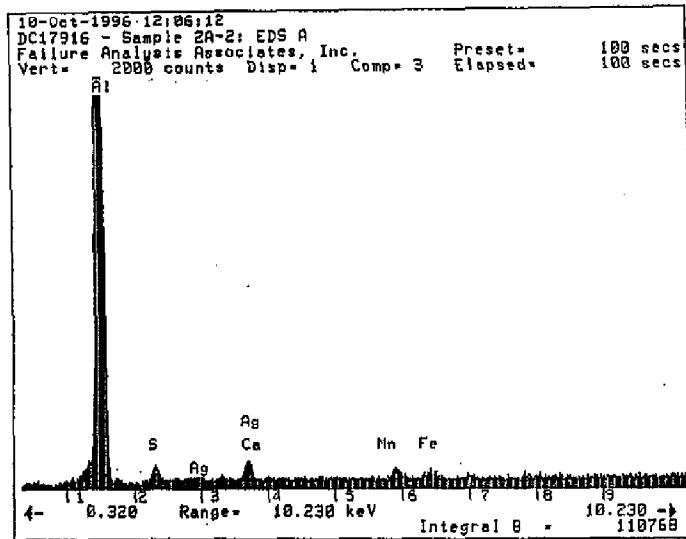


Figure 12. Fractography of fracture surface (planar region) from fragment 2A-2.  
 (a) Optical fractograph depicting the neck region.  
 Note the locations 1, 2, and 3.  
 Photo ID: DC17916-PAL-4-10/15/97.  
 (b) SEM fractograph from region 1. 250X  
 Photo ID: DC17916-PAL-1-01/15/97.  
 (c) SEM fractograph from region 1. 1000X.  
 Photo ID: DC17916-PAL-4-01/15/97.  
 (d) SEM fractograph from region 2. 250X  
 Photo ID: DC17916-PAL-2-01/15/97.  
 (e) SEM fractograph from region 2. 1000X.  
 Photo ID: DC17916-PAL-5-01/15/97.  
 (f) SEM fractograph from region 3. 250X.  
 Photo ID: DC17916-PAL-3-01/15/97.  
 (g) SEM fractograph from region 3. 1000X.  
 Photo ID: DC17916-PAL-6-01/15/97.  
 Note: Arrows in (a) define apparent beach mark.



(a)

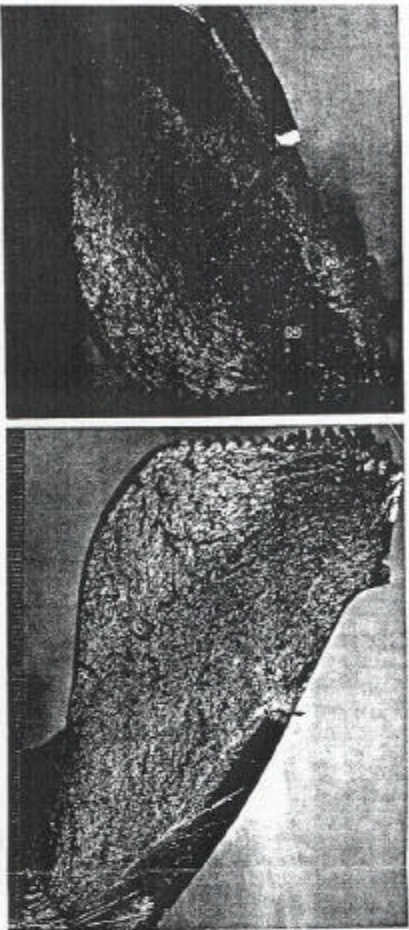


(b)

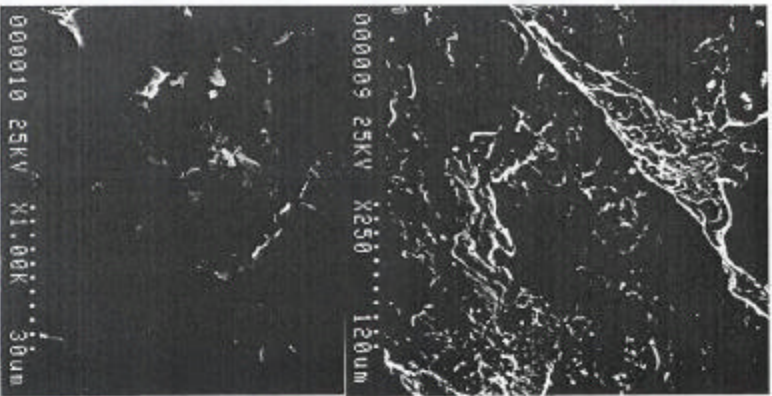
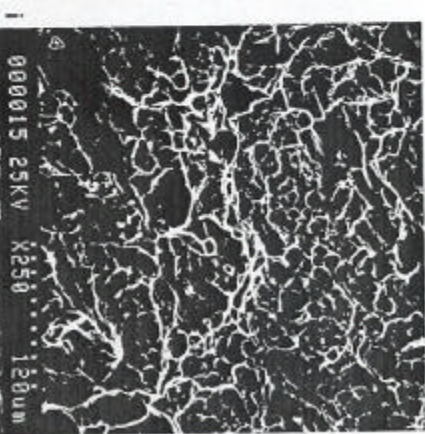
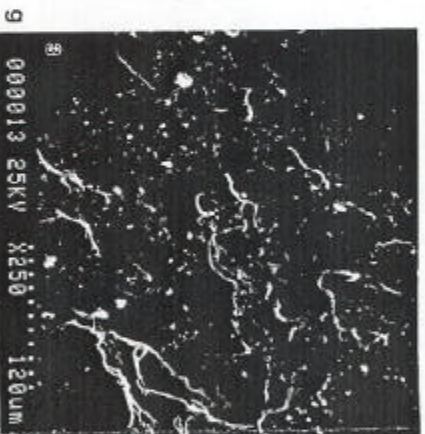
Figure 13. EDS Spectra captured from the flat-faced fracture surface.  
 (a) Region 1.  
 (b) Region 2.



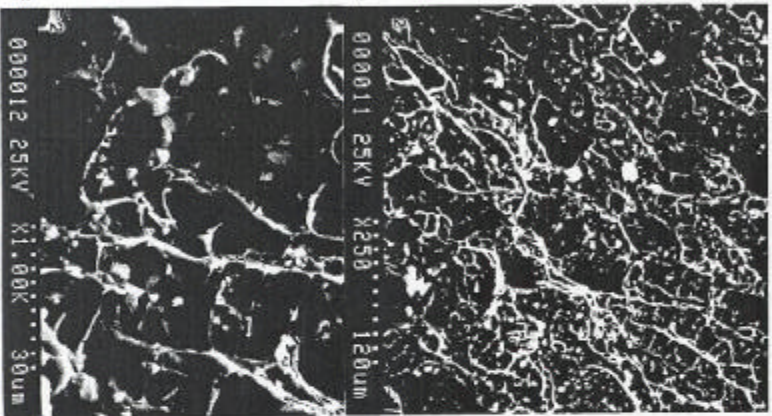




b



e



f

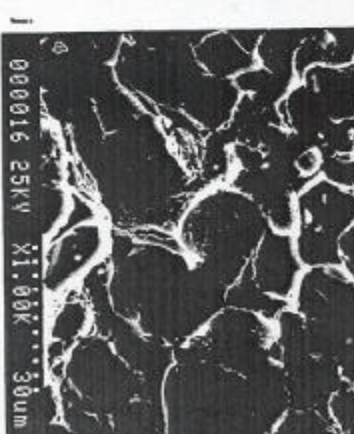
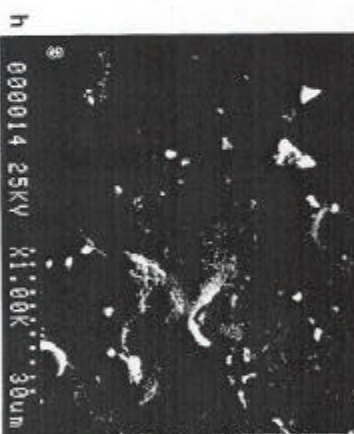


Figure 14.

Fractography of fracture surfaces of crack SC2 forced open in the laboratory.

(a) Fracture surface. Photo ID: DCI7916-PAL-17A-12/10/96.

Scale is in 0.05 inch increments. Note regions 1, 2, 3, and 4.

(b) Mating fracture surface to (a). Photo ID: DCI7916-PAL-18A-12/10/96.

Scale is in 0.05 inch increments.

(c) SEM fractograph from region 1. 250X.

Photo ID: DCI7916-PAL-9-01/15/97.

(d) SEM fractograph from region 1. 1000X.

Photo ID: DCI7916-PAL-10-12/10/96.

(e) SEM fractograph from region 2. 250X.

Photo ID: DCI7916-PAL-11-12/10/96.

(f) SEM fractograph from region 2. 1000X.

Photo ID: DCI7916-PAL-12-12/10/96.

(g) SEM fractograph from region 3. 250X.

Photo ID: DCI7916-PAL-13-12/10/96.

(h) SEM fractograph from region 3. 1000X.

Photo ID: DCI7916-PAL-14-12/10/96.

(i) SEM fractograph from region 4. 250X.

Photo ID: DCI7916-PAL-15-12/10/96.

(j) SEM fractograph from region 4. 1000X.

Photo ID: DCI7916-PAL-16-12/10/96.