

## Appendix C1

### SEM/EDS Data for Unused and Test-2 Day-30 Aluminum Coupons

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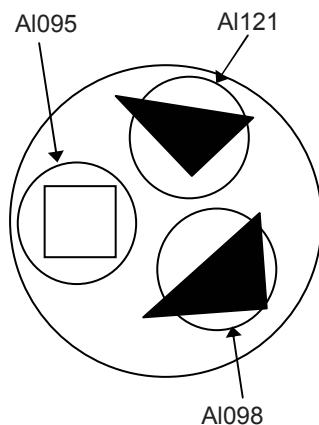
This appendix shows SEM/EDS results for the metal aluminum coupons in three different exposure categories: (1) unused; (2) suspended or unsubmerged; and (3) submerged. *Unused* refers to the coupon condition that existed before being subjected to ICET test conditions. *Suspended* or *unsubmerged* refers to coupons located above the water level of the solution during ICET tests. Suspended coupons contacted the solution only during the 4-hour spray period at the start of the test. In addition, the surface of the suspended coupons may also be affected by moisture in the test chamber gas space. *Submerged* refers to the coupons that were immersed in the test solution for the entire test.

The coupon samples were collected on March 7, 2005 (the date Test #2 was shut down) and were examined by SEM/EDS on March 21, 2005. The aluminum coupon samples were dried in air before being coating with carbon for SEM examination. SEM results illustrate the surface condition of the aluminum coupons. In addition, EDS results provide spectra and semiquantitative elemental analyses of the coupon surface and the corrosion and deposition products that were found to be present.

## Transcribed Laboratory Log

Laboratory session from March 21, 2005

Aluminum Sample



Conditions: 15-kV, 1-nA beam current, Aperture=2

Metal	Sample	Test
Aluminum:	Al-095	Unused Al-095
	Al-098	Submerged Al-098
	Al-121	Unsubmerged Al-121

Note: All samples were carbon coated

### Sample Al-095 (Unused)

Image:	Al095001	40 ×	Overview SEI	Figure C1-1
	Al095002	150 ×	SEI surface	Figure C1-2
	Al095003	150 ×	BEI surface	Figure C1-3
	Al095004	1000 ×	SEI on contam. “flowers” in image 003	Figure C1-4
EDS:	AlEDS1		Contaminant “flower” on Al	Figure C1-5
Image:	Al095005	1000 ×	SEI metal surface	Figure C1-6
	Al095006	1000 ×	BEI metal surface w/ numerous inclusions	Figure C1-7
EDS:	AlEDS2		Bright inclusion in Al	Figure C1-8
	AlEDS3		Average composition at 1000 ×	Figure C1-9

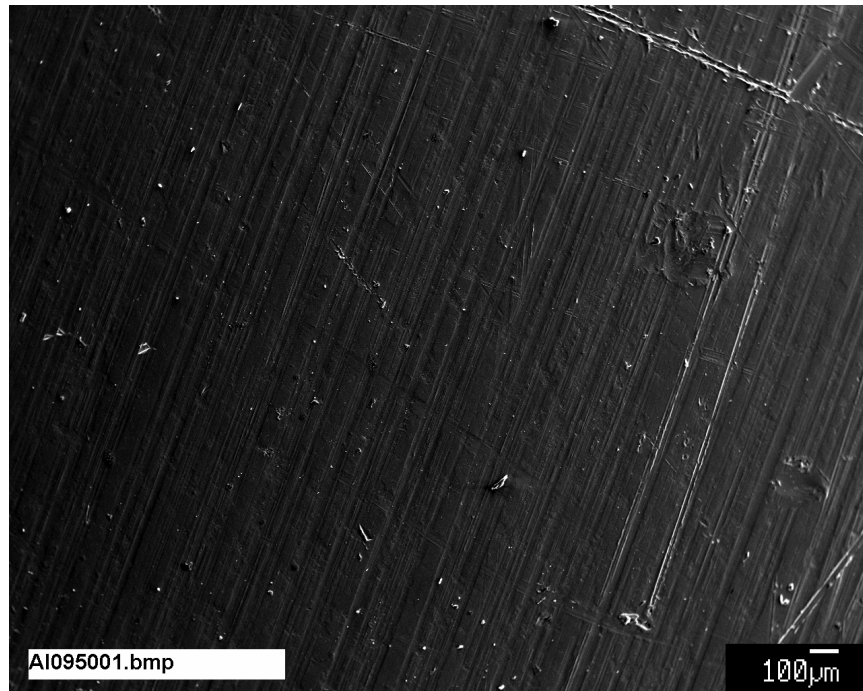


### Sample Al-098 Test #2 (Submerged)

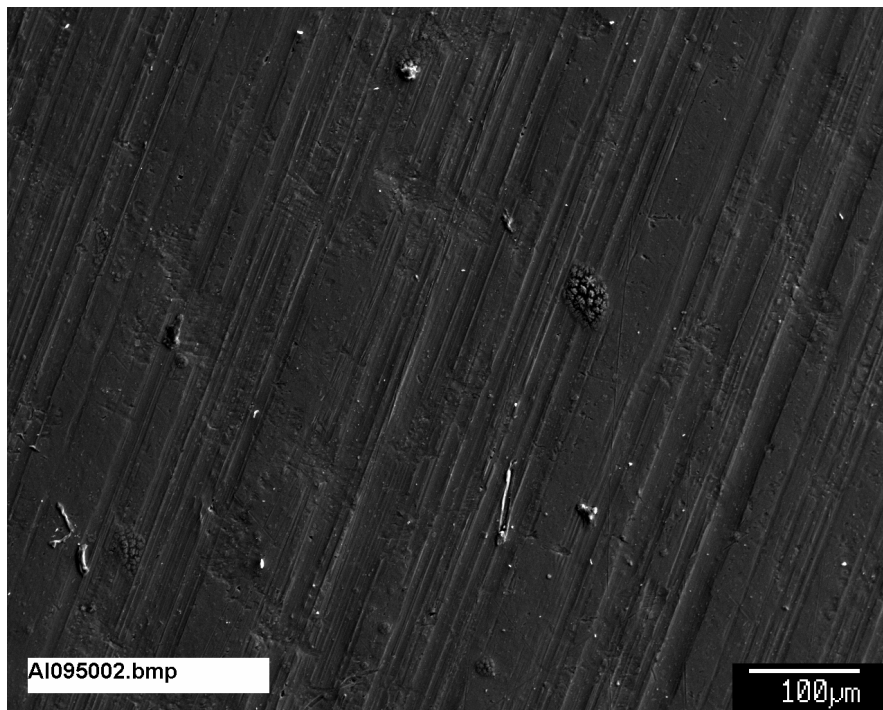
Image:	Al098007	40 ×	Overview on corroded surface	Figure C1-10
	Al098008	150 ×	On corrosion product (SEI)	Figure C1-11
	Al098009	150 ×	BEI on same area	Figure C1-12
EDS:	AlEDS4		Smooth corrosion product surface	Figure C1-13
Image:	Al098010	1000 ×	SEI on surface & crystals	Figure C1-14
	Al098011	1000 ×	BEI same area	Figure C1-15
EDS:	AlEDS5		Crystals on Al corrosion product	Figure C1-16
Image:	Al098012	150 ×	SEI corroded Al surface (hole in corrosion layer)	Figure C1-17
	Al098013	1000 ×	SEI close-up of corroded surface in hole	Figure C1-18
EDS:	AlEDS6		Wormlike feature on corroded Al in image 013	Figure C1-19

### Sample Al-121 Test #2 (Unsubmerged)

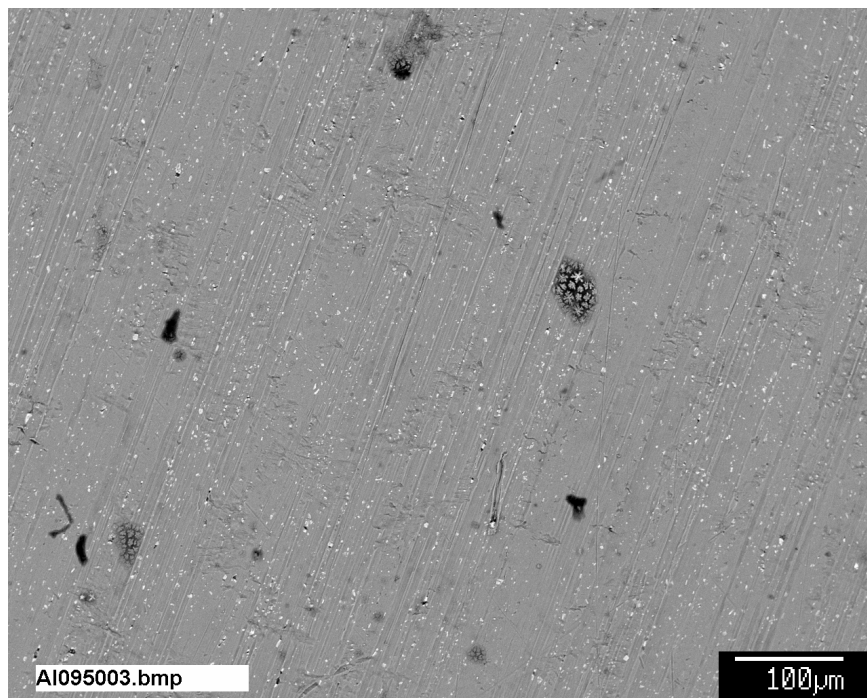
Image:	Al121014	40 ×	Overview of surface SEI	Figure C1-20
	Al121015	40 ×	BSE same area	Figure C1-21
	Al121016	150 ×	SEI on circle in image 015	Figure C1-22
	Al121016annotated		Annotated Photoshop picture of EDS sample locations.	Figure C1-23
	Al121017	150 ×	BEI same area	Figure C1-24
EDS:	AlEDS7		Dark splotch (in image 017)	Figure C1-25
	AlEDS8		Wormlike crystals (see Al121016annotated below)	Figure C1-26
	AlEDS9		Surface away from crystals (see Al121016annotated below)	Figure C1-27
Image:	Al121018	1000 ×	SEI wormlike crystals (see Al121016annotated below)	Figure C1-28



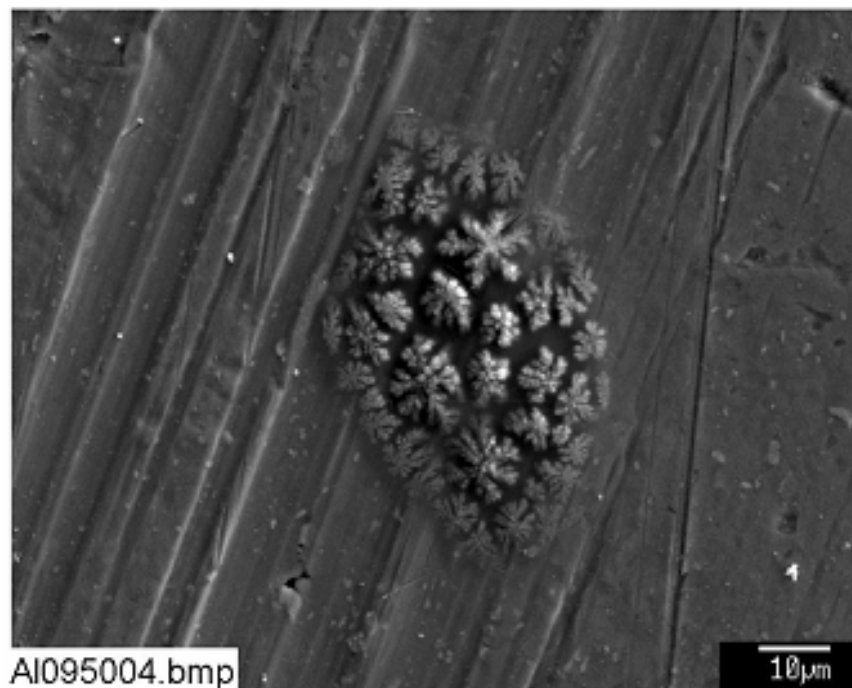
**Figure C1-1. SEM image at 40× magnification for an unused aluminum coupon (Al095001).**



**Figure C1-2. SEM image at 150× magnification for an unused aluminum coupon (Al095002).**



**Figure C1-3. Backscattered SEM image at 150× magnification for an unused aluminum coupon (Al095003).**



**Figure C1-4. SEM image closeup (1000×) of contaminant “flower” on an unused aluminum coupon as shown in Figure C1-3 (Al095004).**

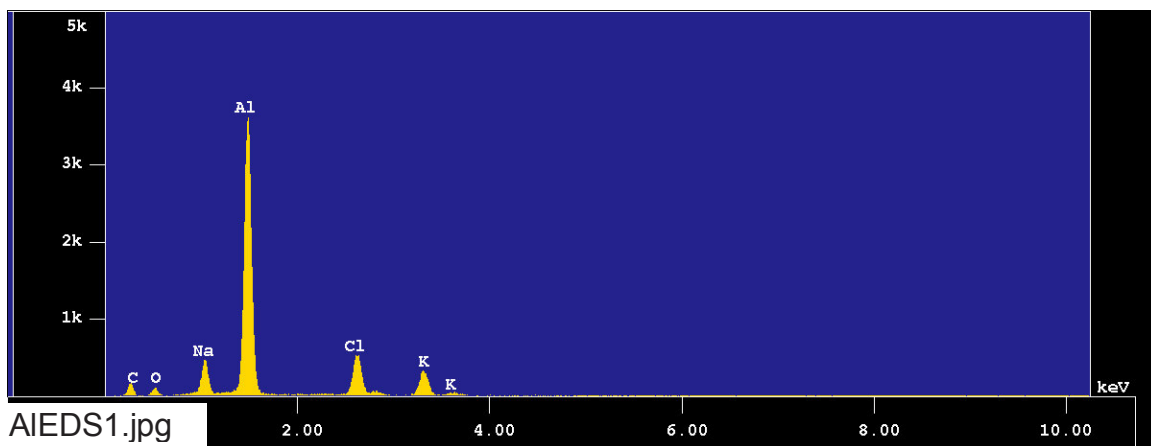


Figure C1-5. EDS counting spectrum for the contaminant “flower” shown in Figure C1-4 (AIEDS1).

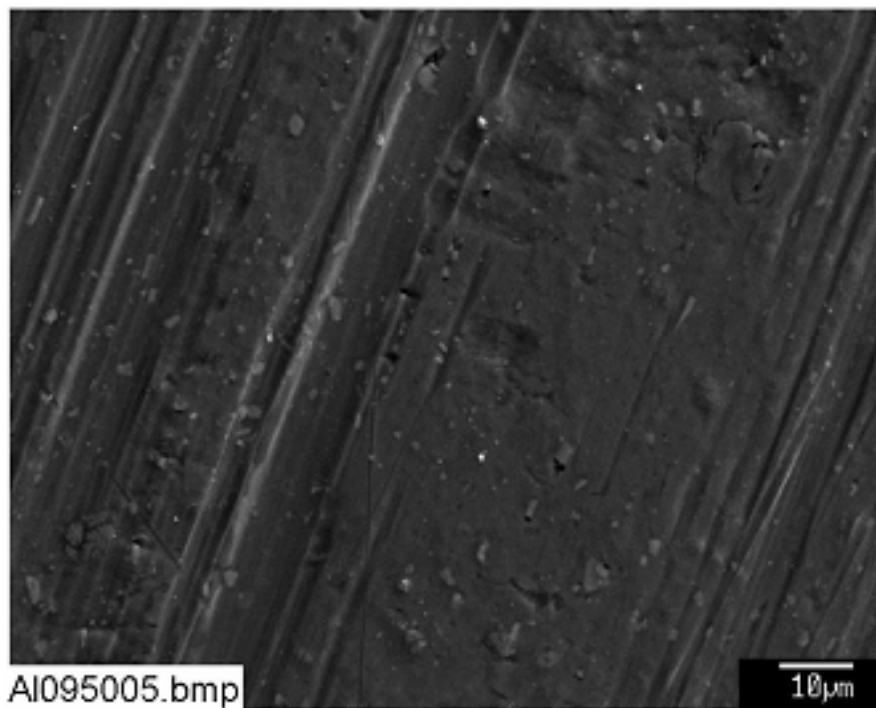
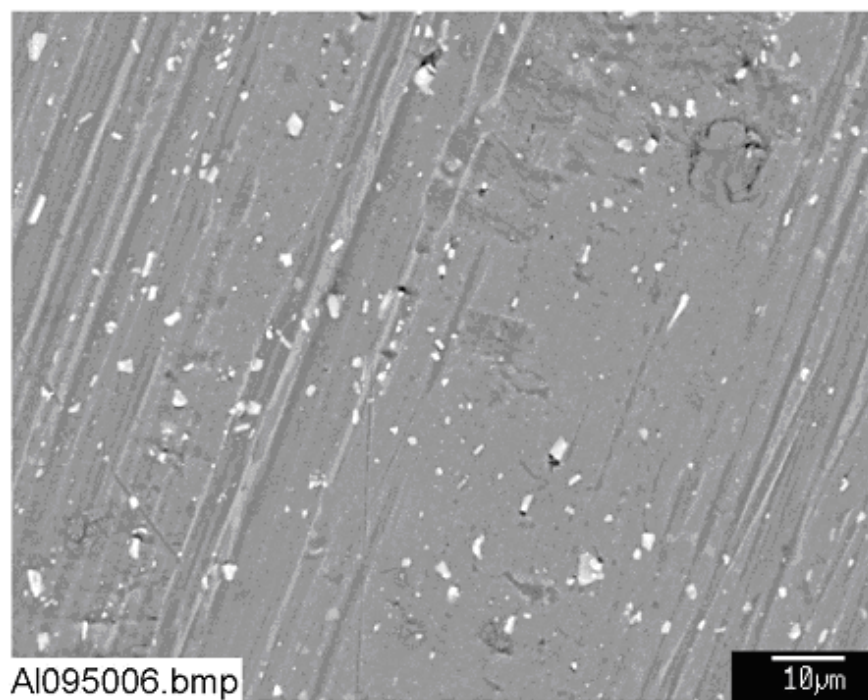
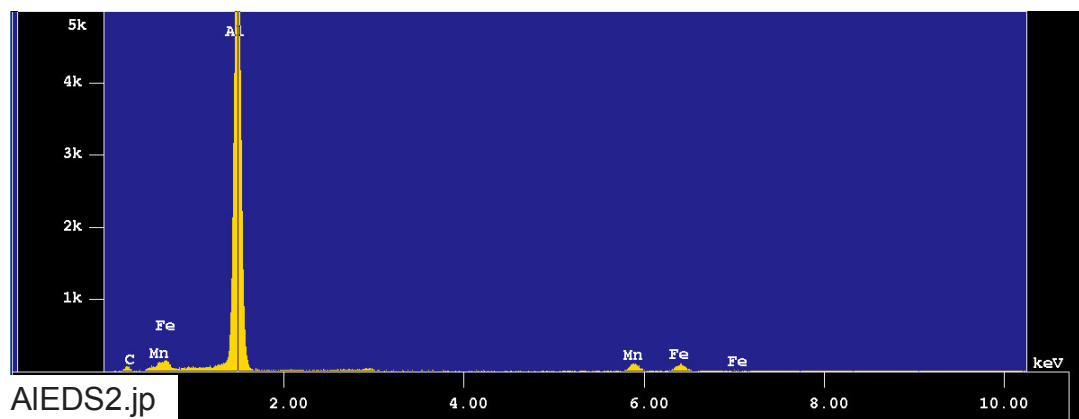


Figure C1-6. SEM image at 1000× magnification for an unused aluminum coupon (Al095005).

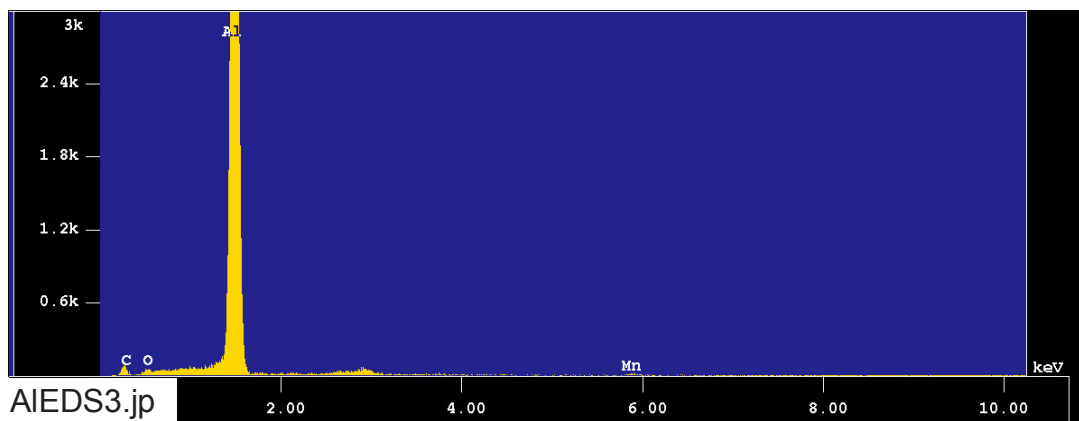




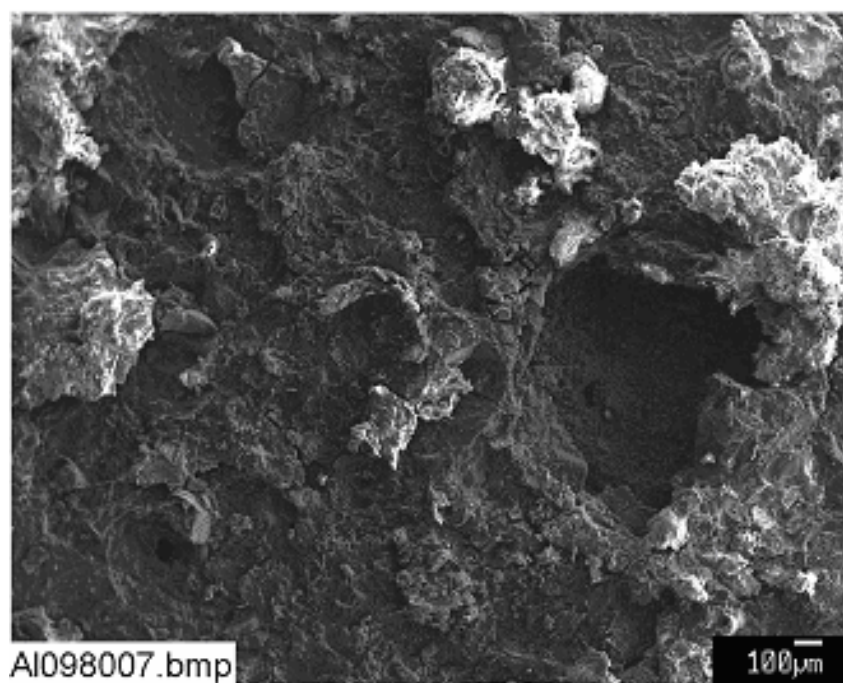
**Figure C1-7. Backscattered SEM image at 1000× magnification for an unused aluminum coupon (Al095006).**



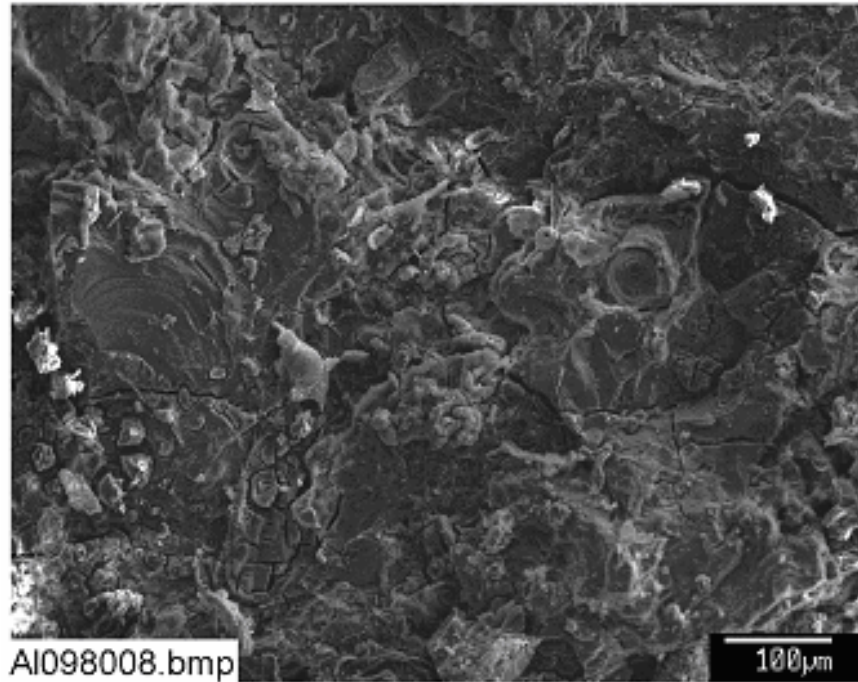
**Figure C1-8. EDS counting spectrum for the white spots shown in Figure C1-7 (AIEDS2).**



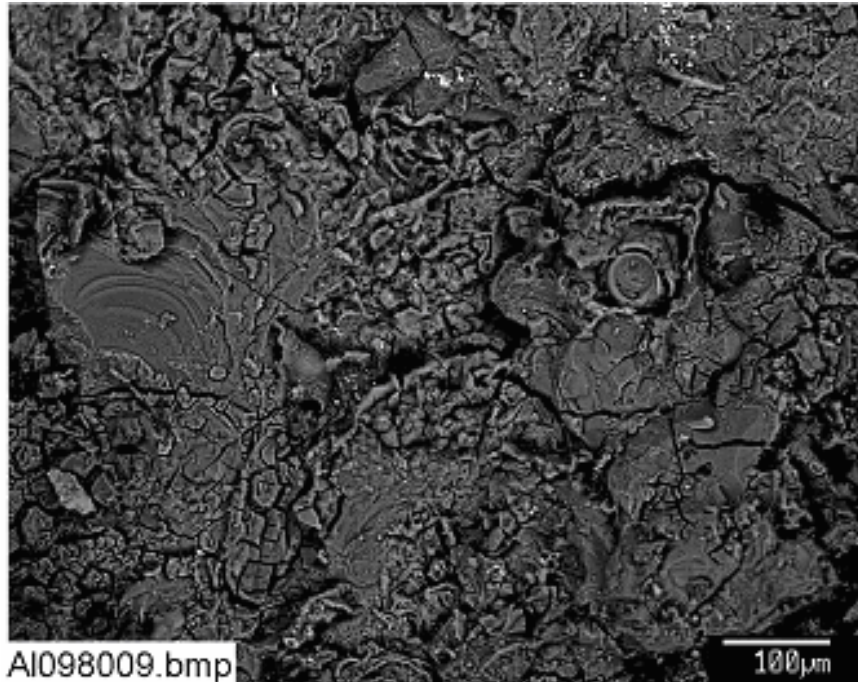
**Figure C1-9. EDS counting spectrum for the average composition of Al coupon shown in Figure C1-7 (AIEDS3).**



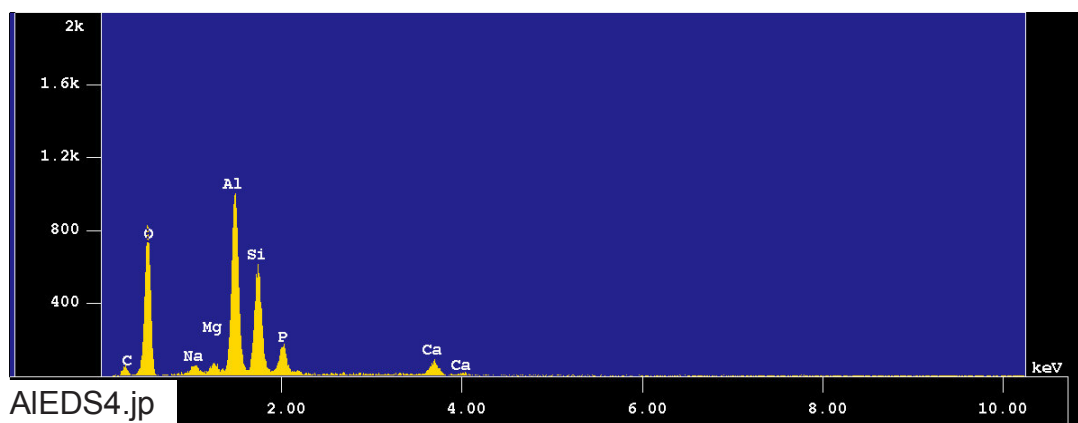
**Figure C1-10. SEM image at 40× magnification for a Test-2 Day-30 submerged aluminum coupon (Al098007).**



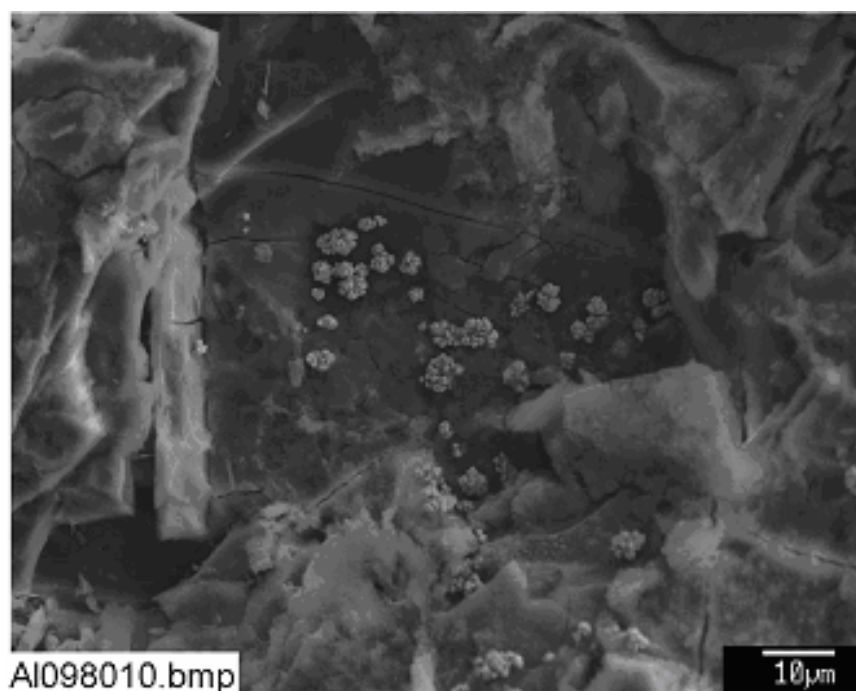
**Figure C1-11. SEM image at 150× magnification for a Test 2 Day-30 submerged aluminum coupon (Al098008).**



**Figure C1-12. Backscattered SEM image at 150× magnification for a Test-2 Day-30 submerged aluminum coupon (Al098009).**

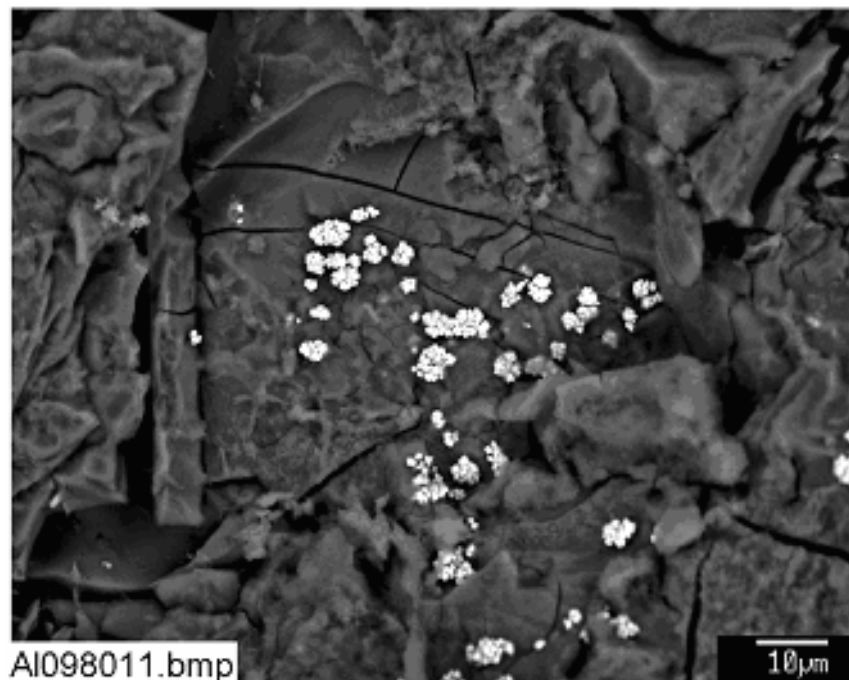


**Figure C1-13. EDS counting spectrum for the smooth corrosion product shown on the surface of an Al coupon in Figure C1-11 (AIEDS4).**

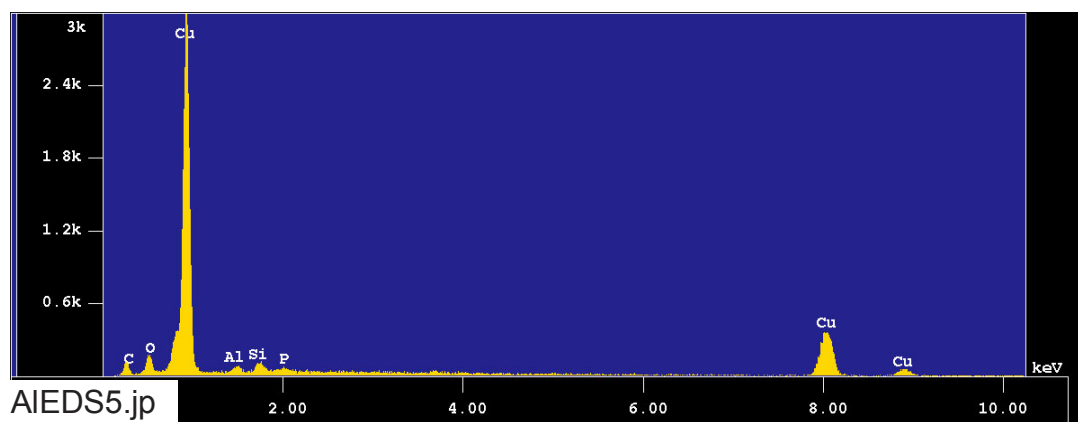


**Figure C1-14. SEM image at higher magnification (1000×) for a Test-2 Day-30 submerged aluminum coupon (A1098010).**

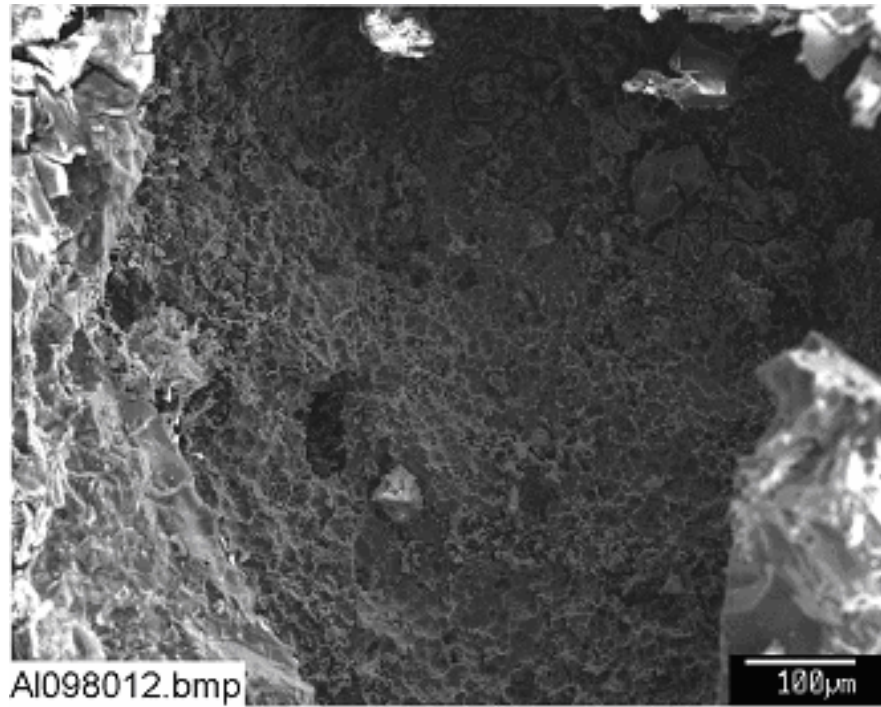




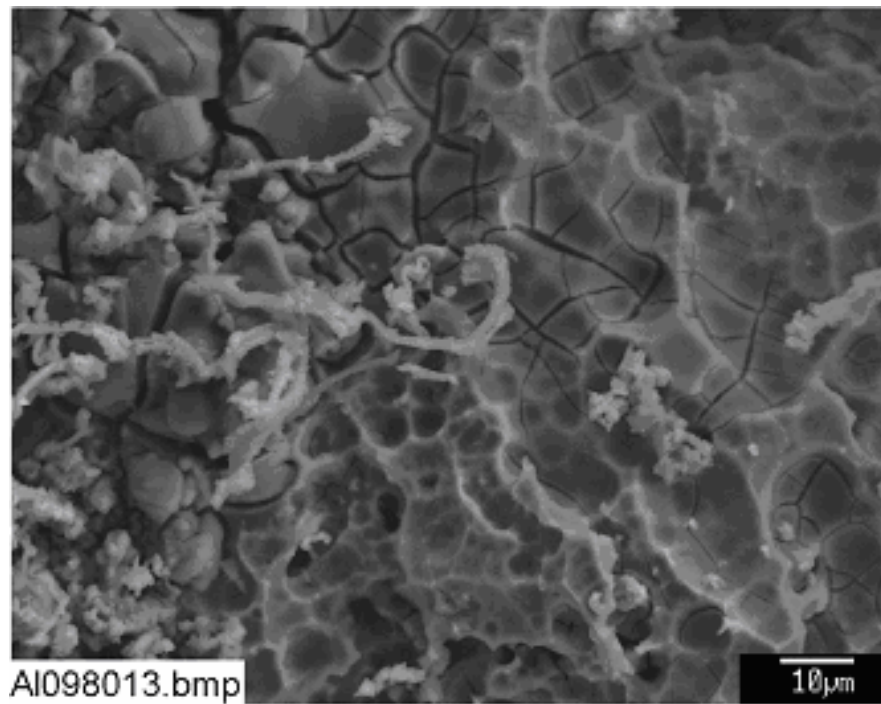
**Figure C1-15. Backscattered SEM image of at higher magnification (1000×) for the same area of submerged aluminum coupon shown in Figure C1-14 (Al098011).**



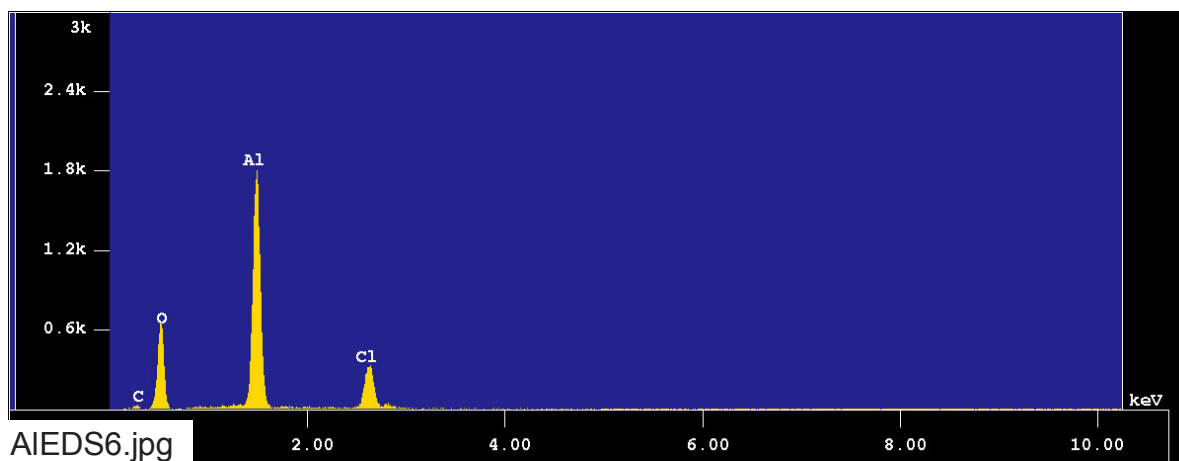
**Figure C1-16. EDS counting spectrum for the crystal corrosion product as shown as white granules in Figure C1-15 (AlEDS5).**



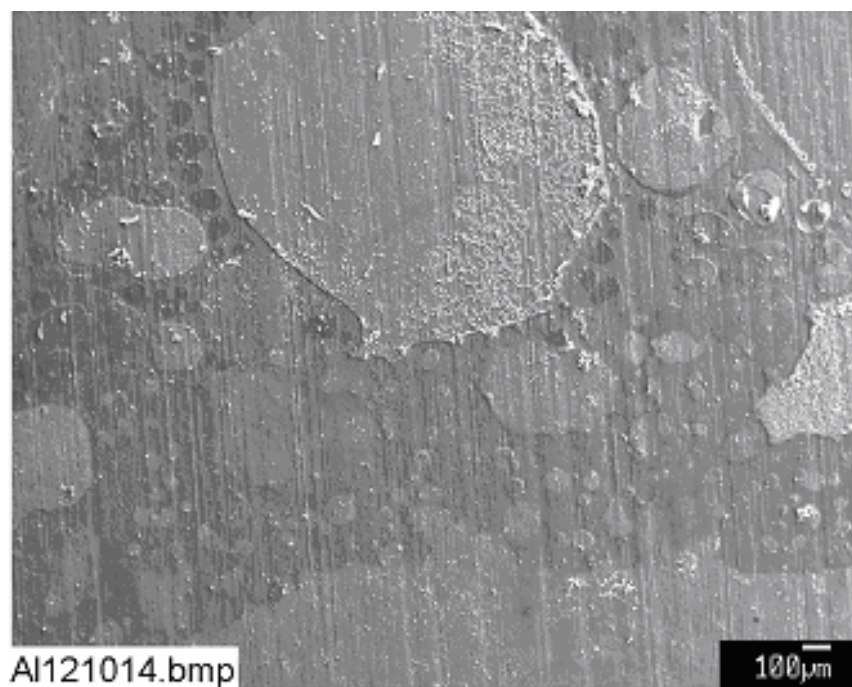
**Figure C1-17. SEM image at 150× magnification for a Test-2 Day-30 submerged aluminum coupon showing a hole or defect in the corrosion layer (Al098012).**



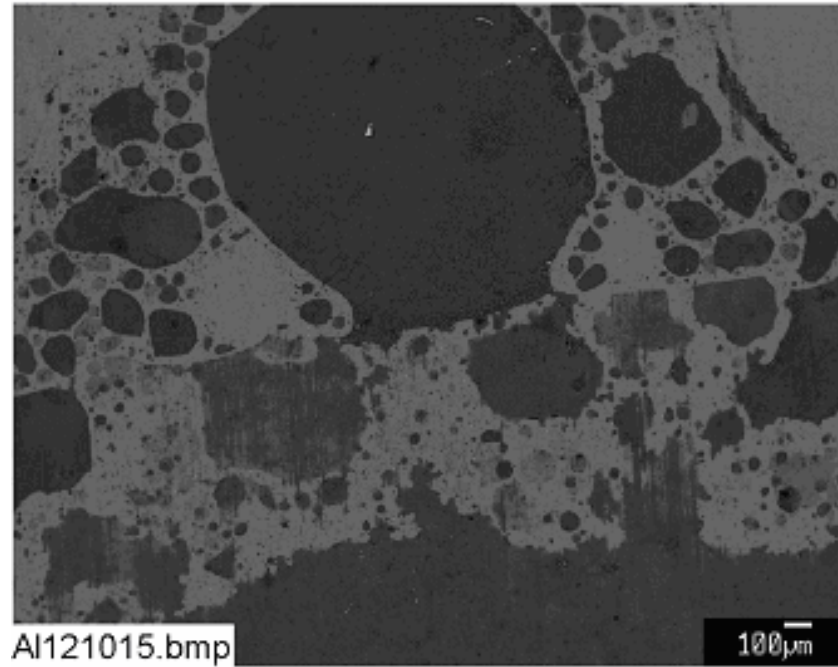
**Figure C1-18. SEM image closeup (1000×) of the surface within the corrosion gap shown in Figure C1-17 on a submerged aluminum coupon (Al098013).**



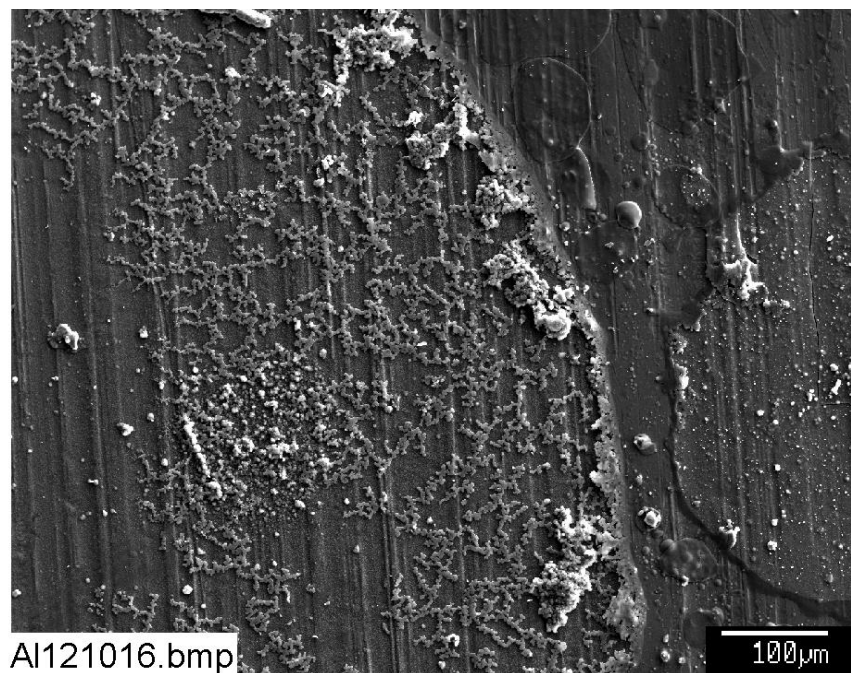
**Figure C1-19. EDS counting spectrum for the wormlike corrosion product shown in Figure C1-18 (AlEDS6).**



**Figure C1-20. SEM image overview at 40× magnification for a Test-2 Day-30 unsubmerged aluminum coupon (Al121014).**

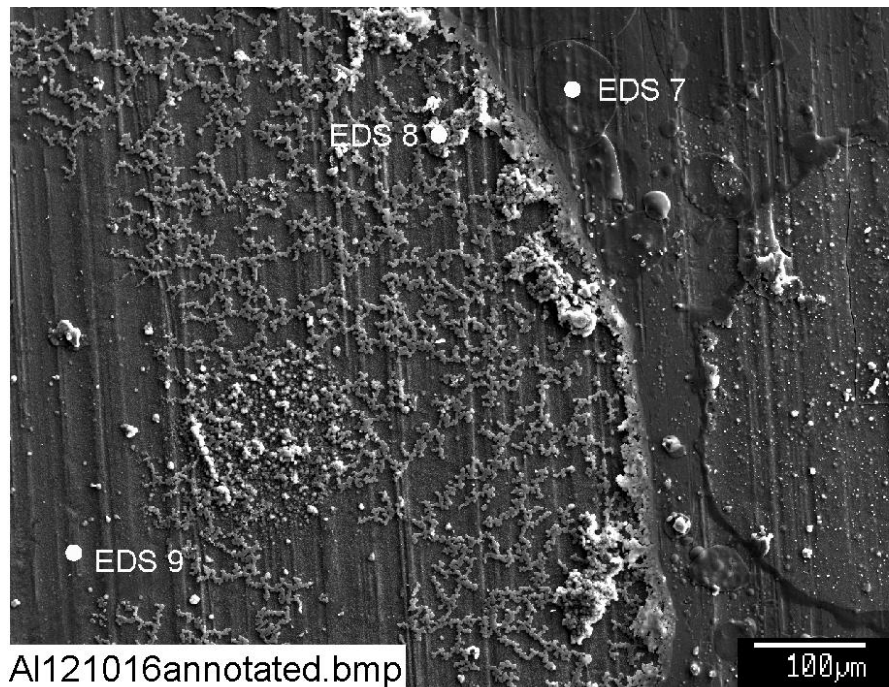


**Figure C1-21. Backscattered SEM image overview at 40× magnification for a Test-2 Day-30 unsubmerged aluminum coupon (Al121015).**

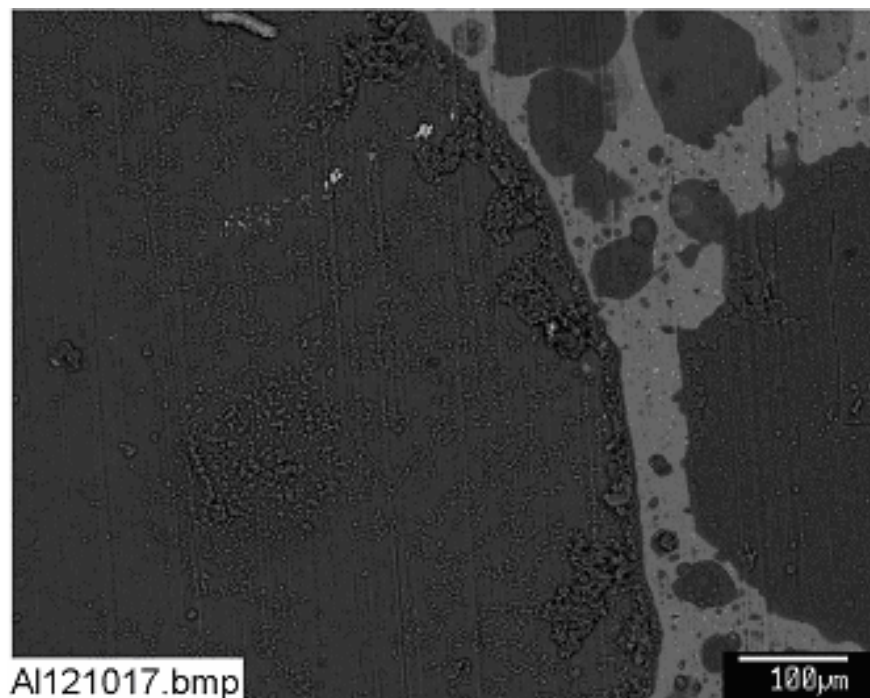


**Figure C1-22. SEM image at 150× magnification for the circular corrosion patches shown in Figure C1-21 for a Test-2 Day-30 unsubmerged aluminum coupon (Al121016).**

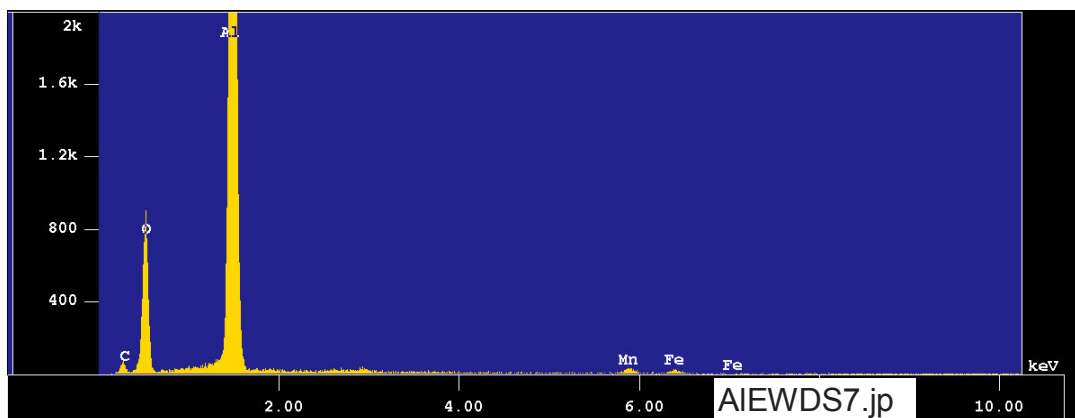




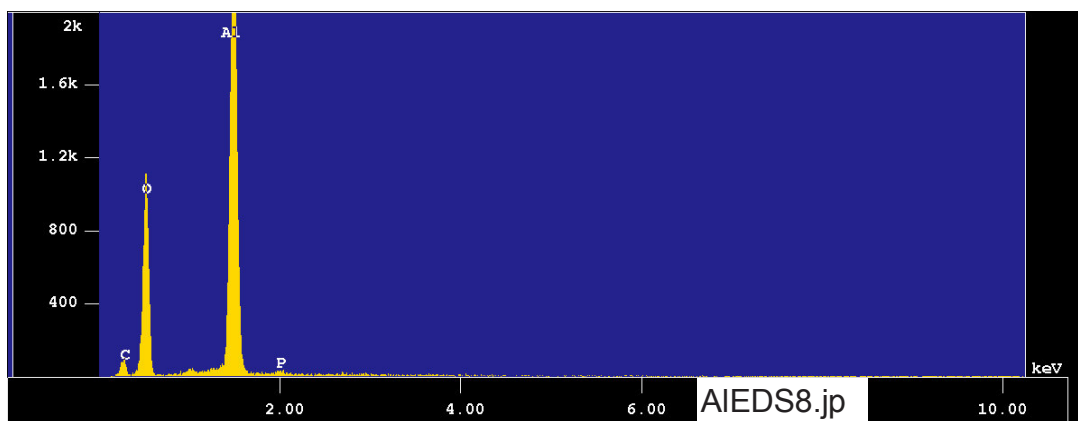
**Figure C1-23. SEM image at 150× magnification for a Test-2 Day-30 unsubmerged aluminum coupon illustrating EDS sampling locations (Al121016annotated).**



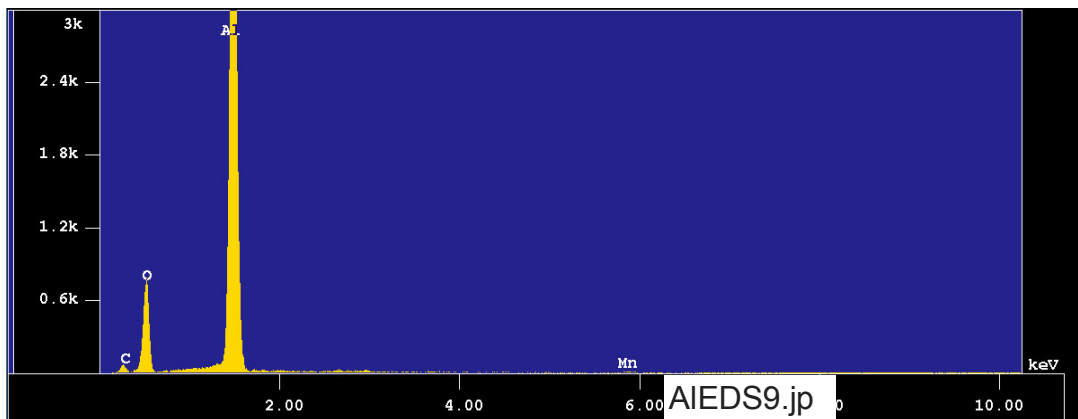
**Figure C1-24. Backscattered SEM image at 150× magnification for the circular corrosion patches shown in Figure C1-21 for a Test-2 Day-30 unsubmerged aluminum coupon (Al121017).**



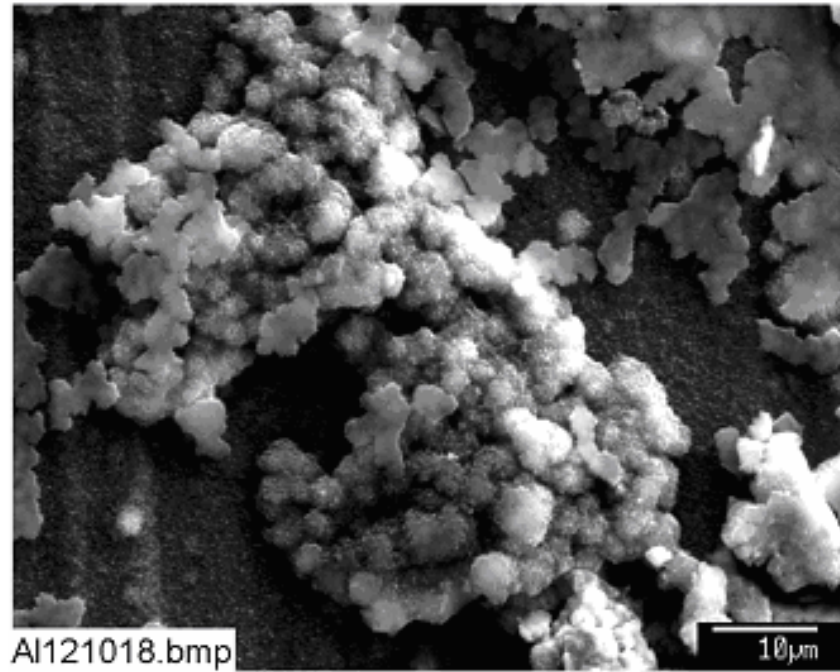
**Figure C1-25. EDS counting spectrum for the dark patch shown in Figure C1-24 (AIEWDS7).**



**Figure C1-26. EDS counting spectrum for the wormlike crystals shown in Figure C1-22 (AIEDS8).**



**Figure C1-27. EDS counting spectrum for the coupon surface away from wormlike crystals shown in Figure C1-22 (AIEDS9).**



**Figure C1-28. SEM image closeup (1000×) of wormlike crystals shown in Figure C1-22 for a Test-2 Day-30 unsubmerged aluminum coupon (Al121018).**



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