

## Appendix C4

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

#### List of Figures

Figure C4-1. SEM image for an unused steel coupon (S014019).....	C4-4
Figure C4-2. SEM image for an unused steel coupon (S014020).....	C4-4
Figure C4-3. Backscattered SEM image for an unused steel coupon (S014021). ....	C4-5
Figure C4-4. SEM image for an unused steel coupon (S014022).....	C4-5
Figure C4-5. EDS counting spectrum for the steel surface shown in Figure C4-4 (SEDS10). ....	C4-6
Figure C4-6. SEM image for a Test-2 Day-30 submerged steel coupon (S007028).....	C4-6
Figure C4-7. SEM image for the corrosion surface of a Test-2 Day-30 submerged steel coupon (S007028annotated).....	C4-7
Figure C4-8. Backscattered SEM image for a Test-2 Day-30 submerged steel coupon (S007029).....	C4-8
Figure C4-9. EDS counting spectrum for the light spot shown in Figure C4-8 (SEDS17). ....	C4-8
Figure C4-10. SEM image for the corrosion surface of a Test-2 Day-30 submerged steel coupon (S007030).....	C4-9
Figure C4-11. EDS counting spectrum for the thin crystals shown in Figure C4-10 (SEDS18). ....	C4-9
Figure C4-12. EDS counting spectrum for the clumps surrounding crystals shown in Figure C4-10 (SEDS19).....	C4-10
Figure C4-13. SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009023).....	C4-11
Figure C4-14. Backscattered SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009024).....	C4-11
Figure C4-15. Annotated backscattered SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009024annotated).....	C4-12
Figure C4-16. EDS counting spectrum for the light streak (EDS-11) shown in Figure C4-15 (SEDS11). ....	C4-12
Figure C4-17. EDS counting spectrum for the light grey streak (EDS-12) shown in Figure C4-15 (SEDS12).....	C4-13

Figure C4-18. EDS counting spectrum for the medium grey spot (EDS-13) shown in Figure C4-15 (SEDS13).....	C4-13
Figure C4-19. EDS counting spectrum for the dark grey spot (EDS-14) shown in Figure C4-15 (SEDS14).....	C4-13
Figure C4-20. EDS counting spectrum for the dark spot (EDS-15) shown in Figure C4-15 (SEDS15). ....	C4-14
Figure C4-21. SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009025). The image shows the interface between badly corroded (right) and less corroded surface (left). ....	C4-14
Figure C4-22. Backscattered SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009026). It shows the same area as shown in Figure C4-21.....	C4-15
Figure C4-23. SEM image for a corroded area of a Test-2 Day-30 unsubmerged steel coupon (S009027).....	C4-15
Figure C4-24. EDS counting spectrum for a clump of round corrosion crystals shown in Figure C4-23 (SEDS16).....	C4-16

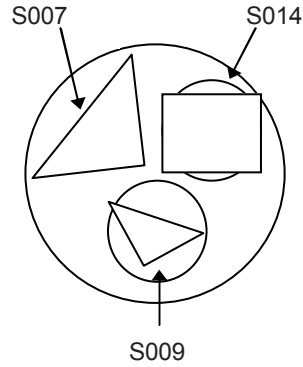
This appendix shows SEM/EDS results for the metal steel coupons in three different categories: (1) unused; (2) suspended or unsubmerged; and (3) submerged. *Unused* refers to the coupon condition before being subjected to ICET test conditions. *Suspended* or *unsubmerged* refers to coupons located above 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 examined by SEM/EDS on March 23, 2005. (The Unused steel coupon was examined on March 21, 2005.) The steel coupon samples were dried in air at room temperature before being coating with carbon for SEM examination. SEM results present the surface condition of the steel coupon. In addition, EDS results provide a semiquantitative elemental analysis of the coupon surface and the corrosion products that are present.

## Transcribed Laboratory Log

Laboratory session from March 21, 2005

### Steel Samples



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

Metal	Sample	Test
Steel:	S014	Unused S014
	S007	Test #2 Submerged S007
	S009	Test #2 Unsubmerged S009

Note: All samples were carbon coated.

### Sample S-014 Unused Steel

Image:	S014019	40 ×	SEI overview of surface	Figure C4-1
	S014020	150 ×	SEI surface	Figure C4-2
	S014021	150 ×	BEI same as above	Figure C4-3
	S014022	1000 ×	SEI close-up	Figure C4-4
EDS:	SEDS10		Steel surface	Figure C4-5

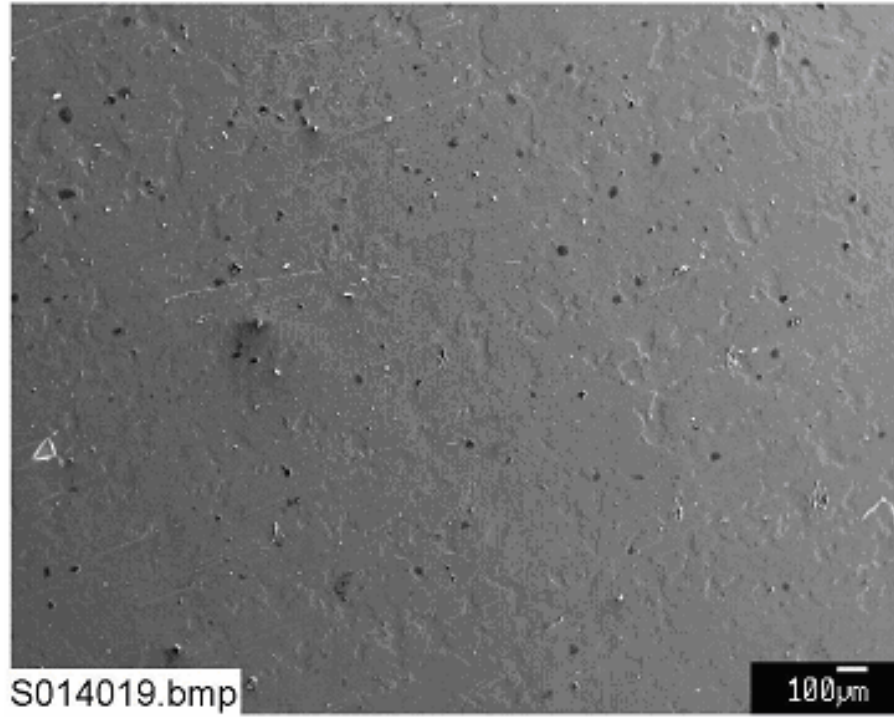


### Sample S007 Test 2 Submerged Steel

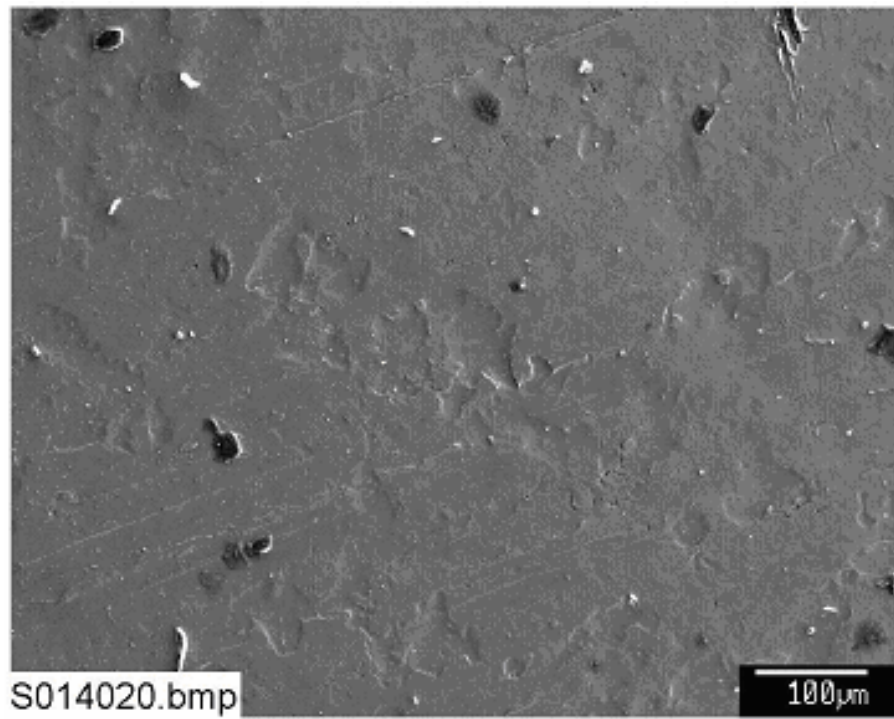
Image:	S007028	150 ×	SEI corroded surface	Figure C4-6
	S007028annotated	150 ×	EDS spots 17–19	Figure C4-7
	S007029	150 ×	BEI same place	Figure C4-8
EDS:	SEDS17		Light area in image 029	Figure C4-9
Image:	S007030	1000 ×	SEI on corrosion surface	Figure C4-10
EDS:	SEDS18		Crystals on corroded steel (see image 030)	Figure C4-11
	SEDS19		Clump of corrosion product	Figure C4-12

### Sample S-009 Unsubmerged Steel

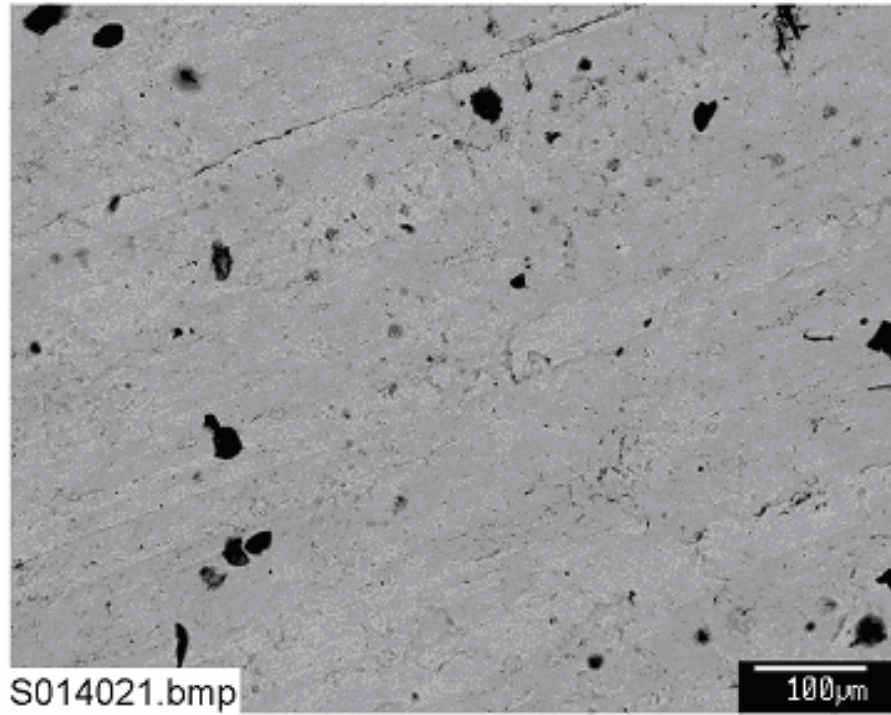
Image:	S009023	40 ×	SEI overview of corroded & noncorroded surface	Figure C4-13
	S009024	40 ×	BEI same area	Figure C4-14
	S009024annotated	40 ×	EDS spots 11–15	Figure C4-15
EDS:	SEDS11		Steel surface- light (in image 024)	Figure C4-16
	SEDS12		Steel—light gray in BSE	Figure C4-17
	SEDS13		Medium gray corrosion on steel	Figure C4-18
	SEDS14		Dark gray corrosion	Figure C4-19
	SEDS15		Dark gray corrosion	Figure C4-20
Image:	S009025	150 ×	SE at interface between badly corroded & less corroded surface	Figure C4-21
	S009026	150 ×	BSE same area	Figure C4-22
	S009027	1000 ×	SE corroded area	Figure C4-23
EDS:	SEDS16		Clump of rounded corrosion crystals	Figure C4-24



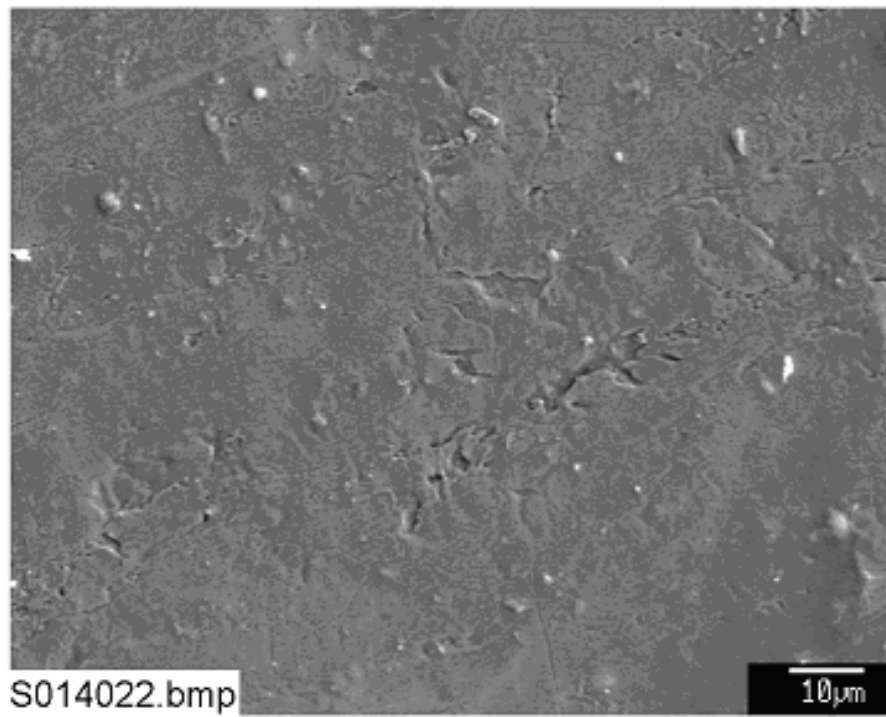
**Figure C4-1. SEM image for an unused steel coupon (S014019).**



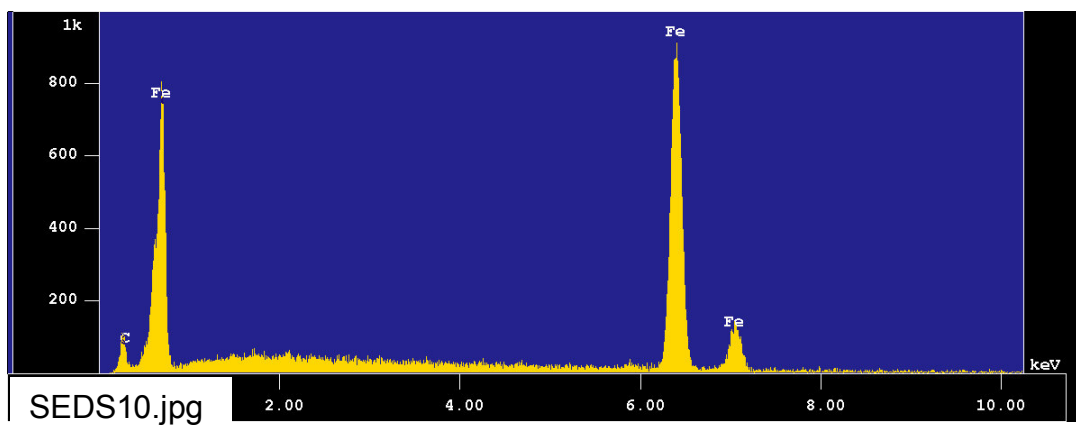
**Figure C4-2. SEM image for an unused steel coupon (S014020).**



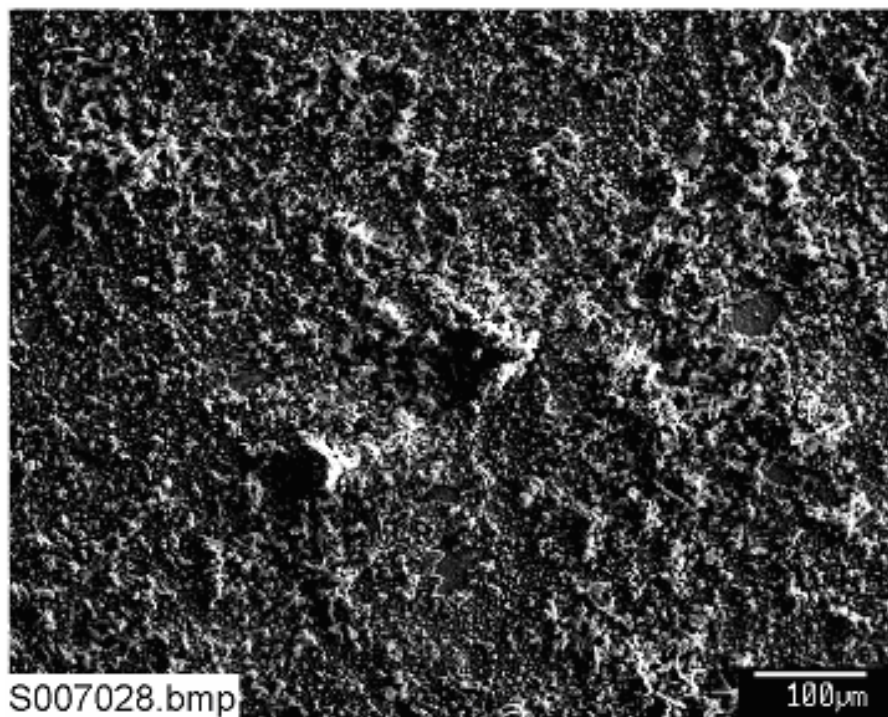
**Figure C4-3. Backscattered SEM image for an unused steel coupon (S014021).**



**Figure C4-4. SEM image for an unused steel coupon (S014022).**

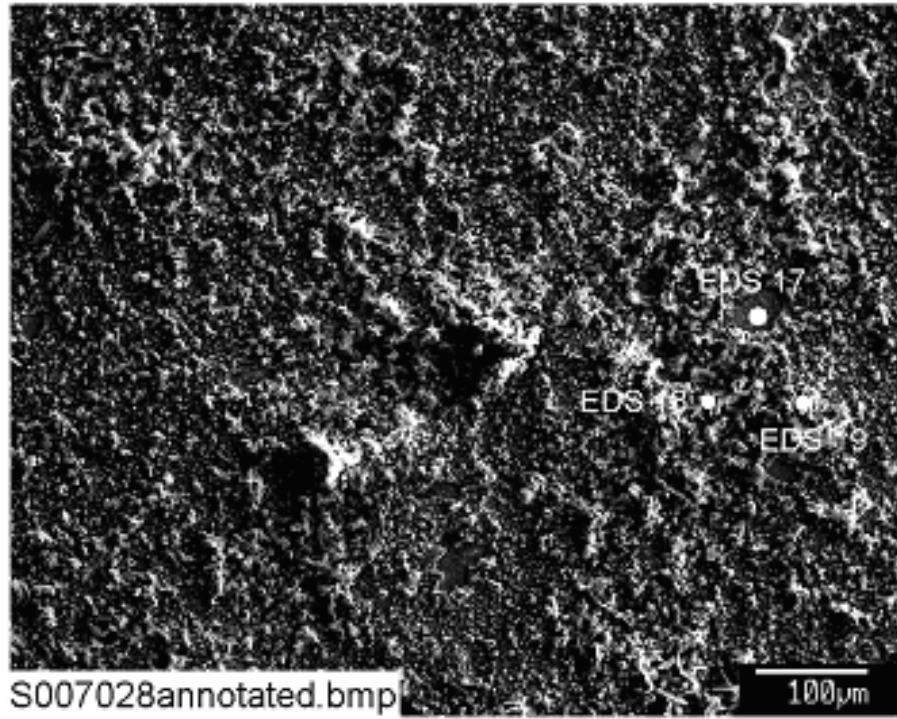


**Figure C4-5. EDS counting spectrum for the steel surface shown in Figure C4-4 (SEDS10).**

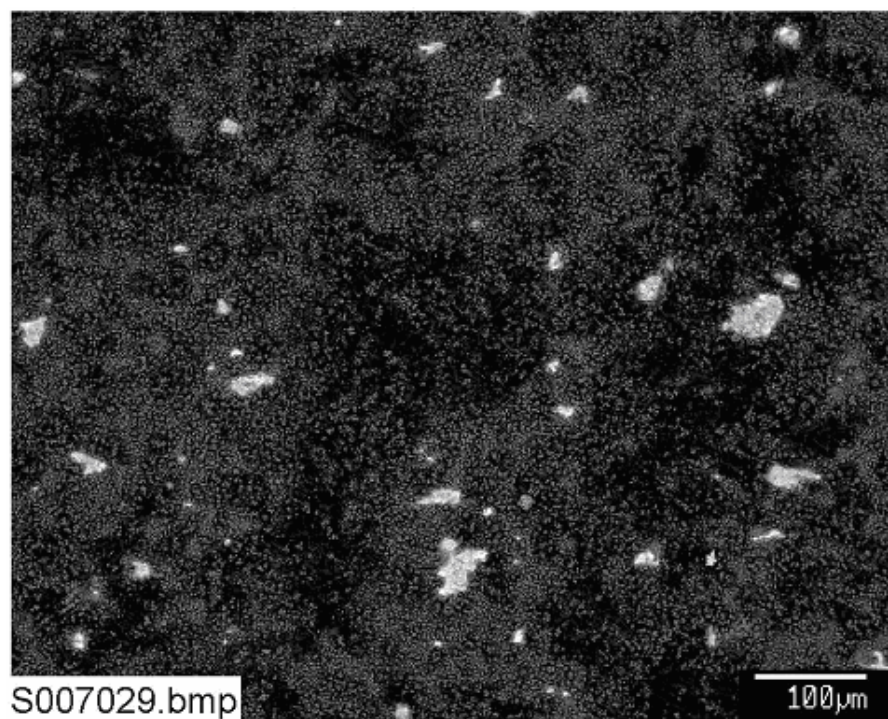


**Figure C4-6. SEM image for a Test-2 Day-30 submerged steel coupon (S007028).**

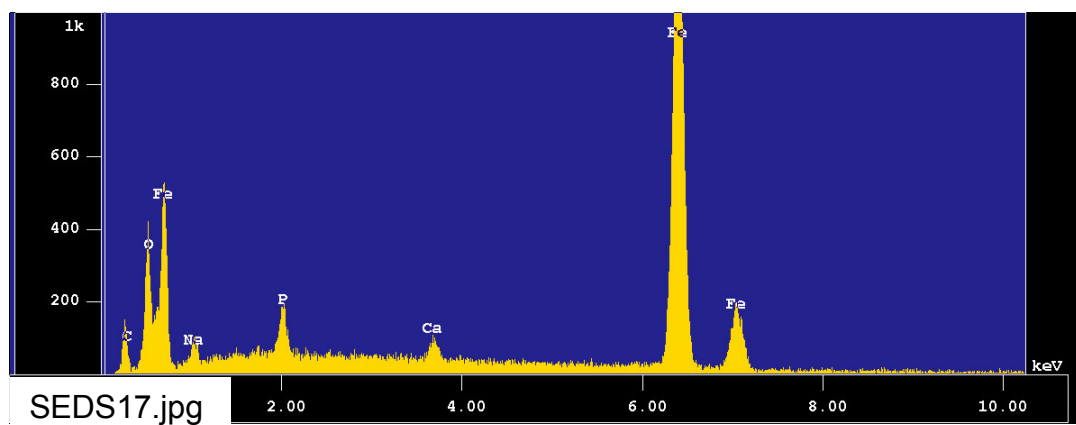




**Figure C4-7. SEM image for the corrosion surface of a Test-2 Day-30 submerged steel coupon (S007028annotated).**



**Figure C4-8. Backscattered SEM image for a Test-2 Day-30 submerged steel coupon (S007029).**



**Figure C4-9. EDS counting spectrum for the light spot shown in Figure C4-8 (SED17).**

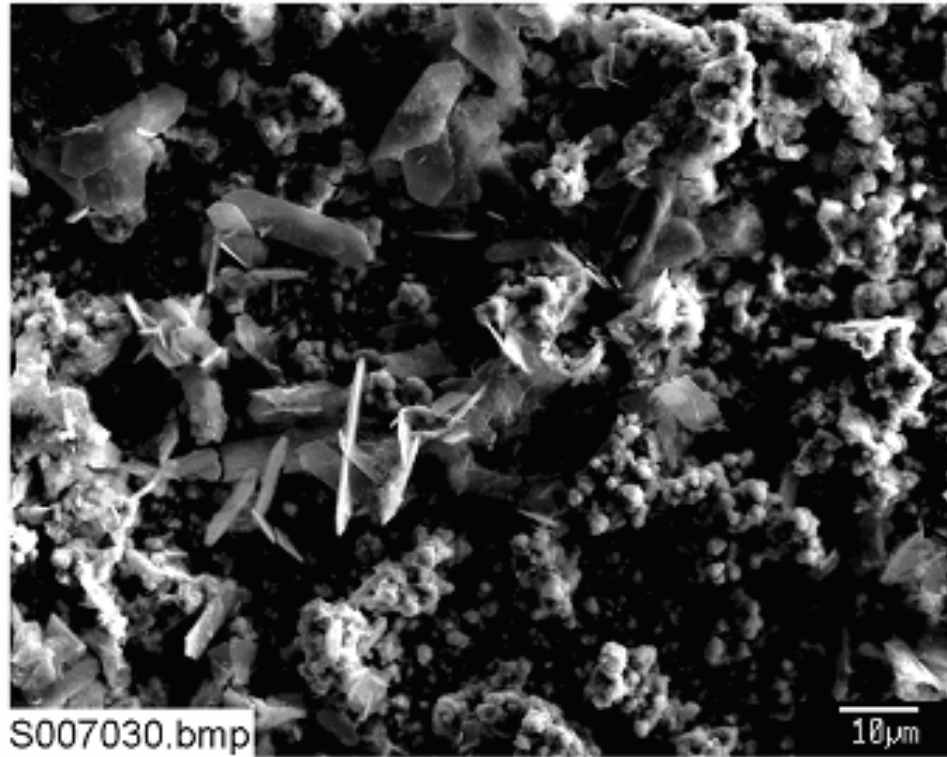


Figure C4-10. SEM image for the corrosion surface of a Test-2 Day-30 submerged steel coupon (S007030).

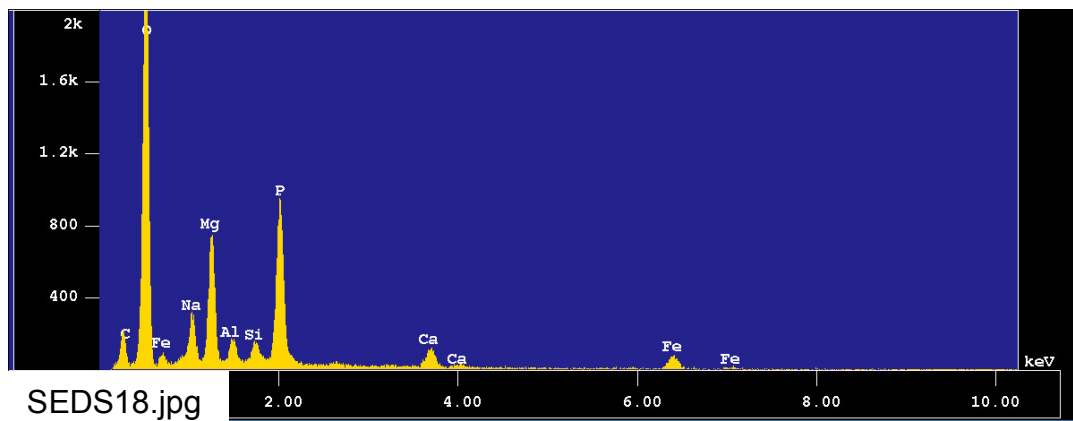
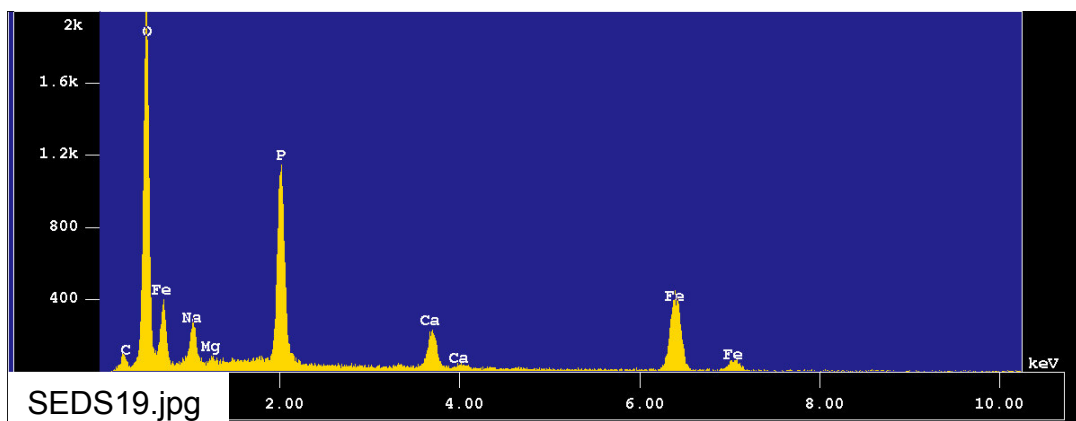
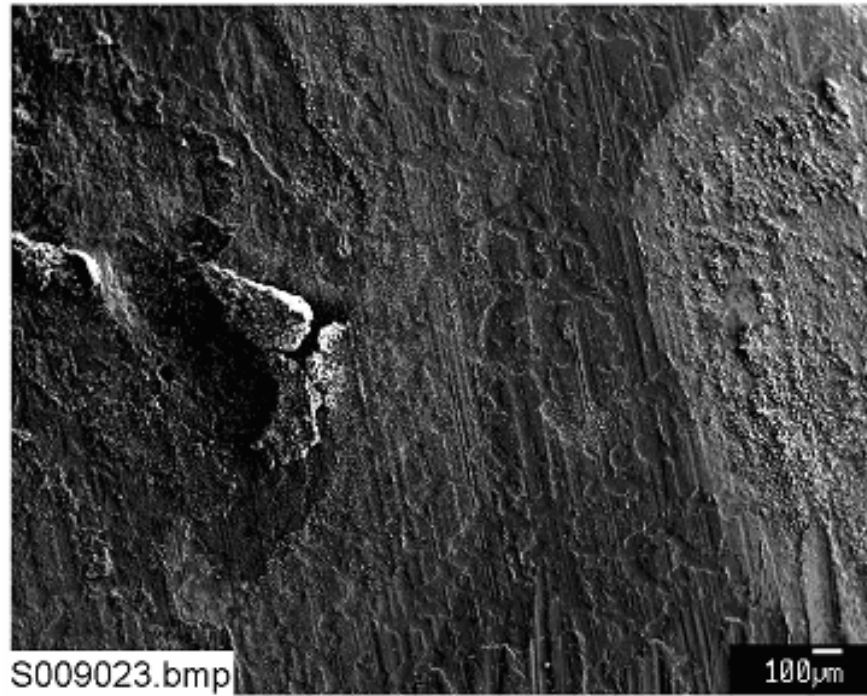


Figure C4-11. EDS counting spectrum for the thin crystals shown in Figure C4-10 (SEDS18).

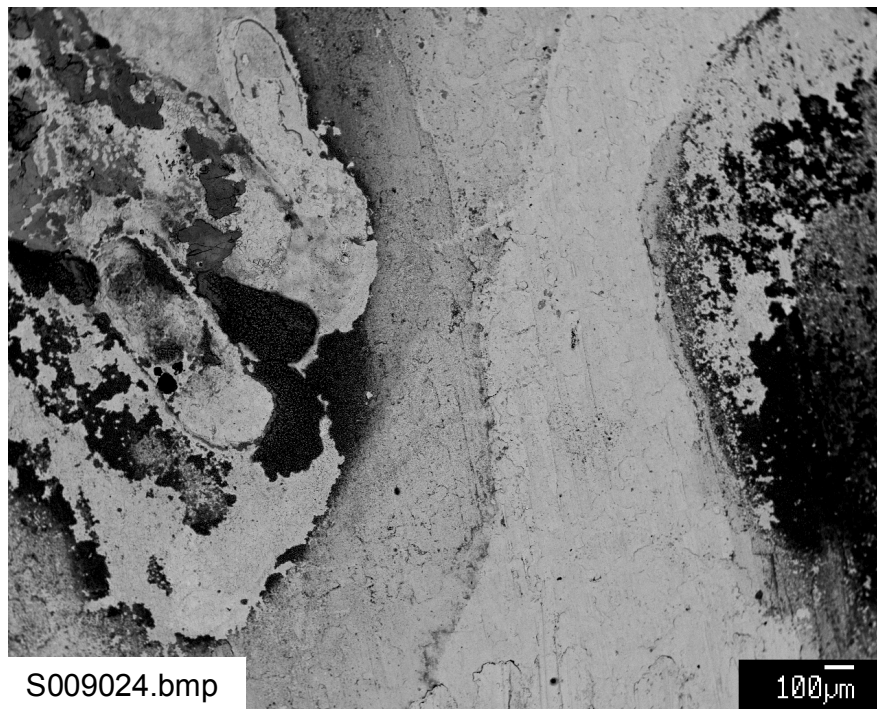


**Figure C4-12. EDS counting spectrum for the clumps surrounding crystals shown in Figure C4-10 (SEDS19).**

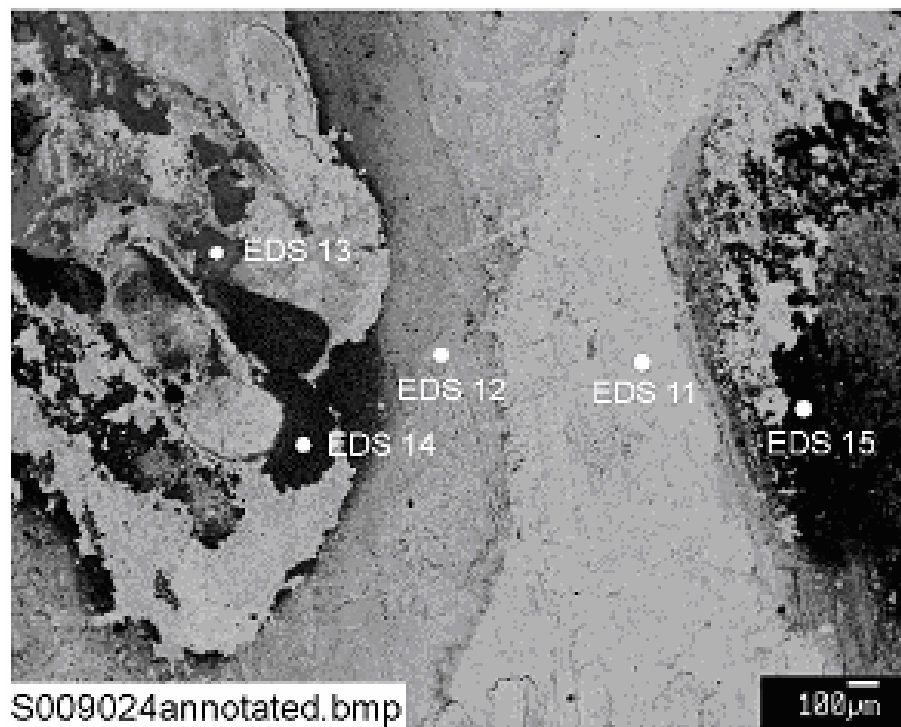




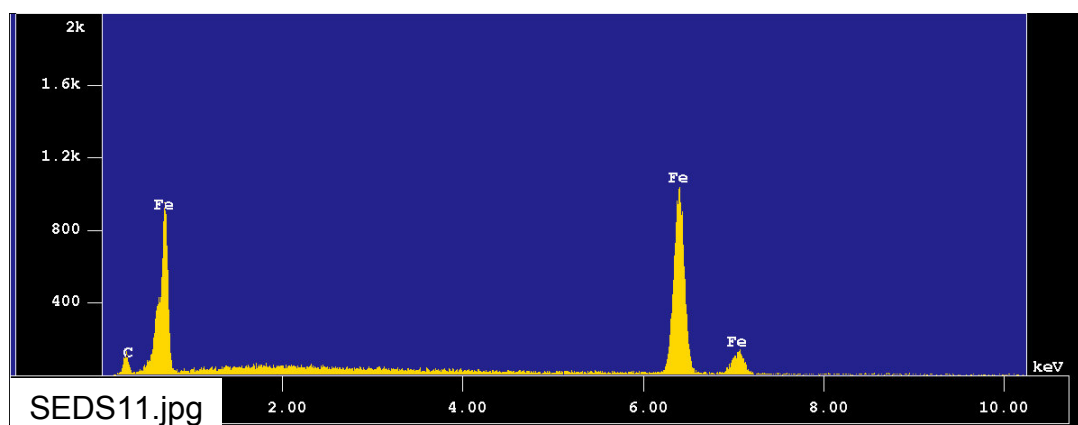
**Figure C4-13. SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009023).**



**Figure C4-14. Backscattered SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009024).**



**Figure C4-15. Annotated backscattered SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009024annotated).**



**Figure C4-16. EDS counting spectrum for the light streak (EDS-11) shown in Figure C4-15 (SEDS11).**

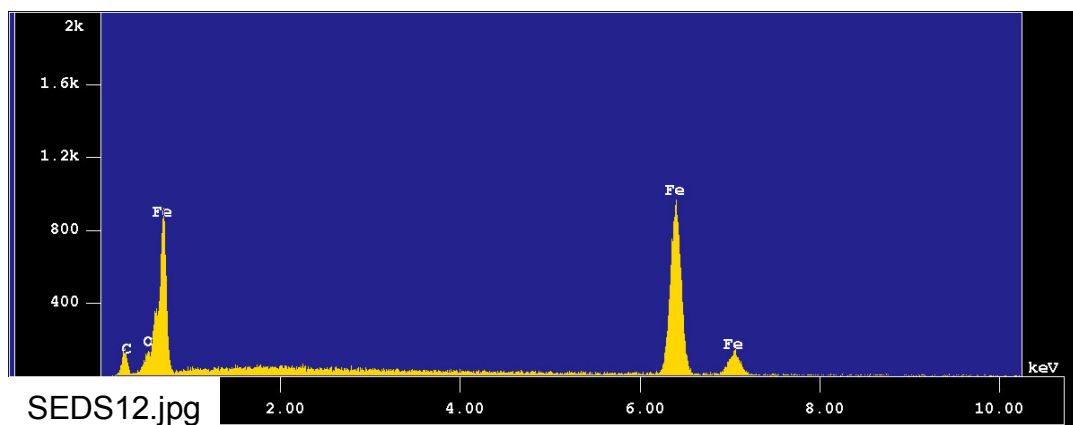


Figure C4-17. EDS counting spectrum for the light grey streak (EDS-12) shown in Figure C4-15 (SEDs12).

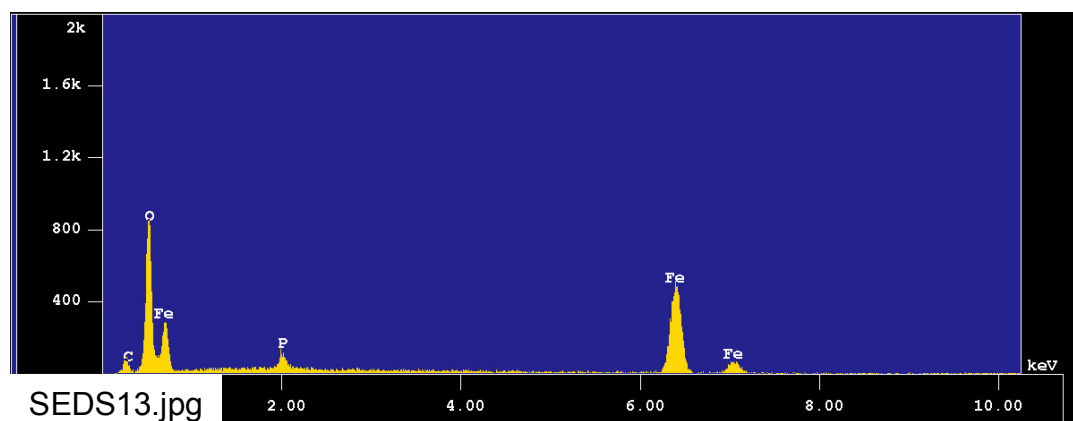


Figure C4-18. EDS counting spectrum for the medium grey spot (EDS-13) shown in Figure C4-15 (SEDs13).

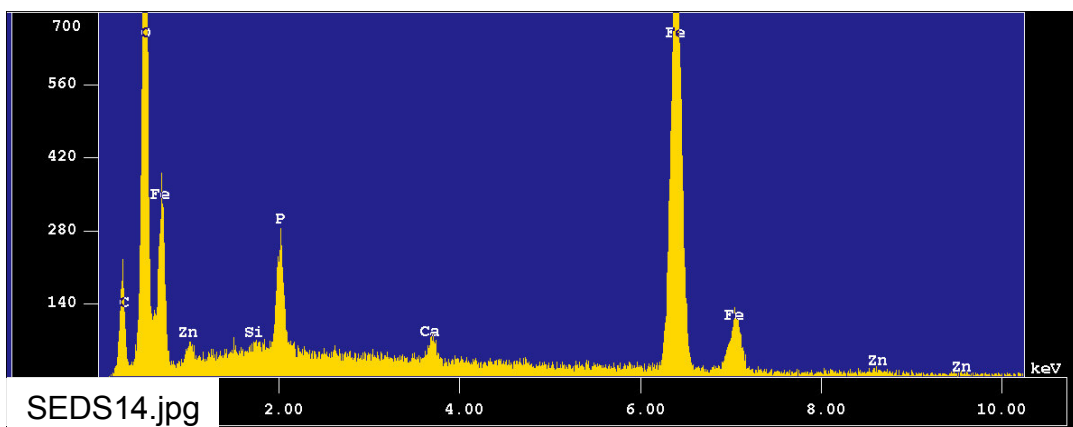
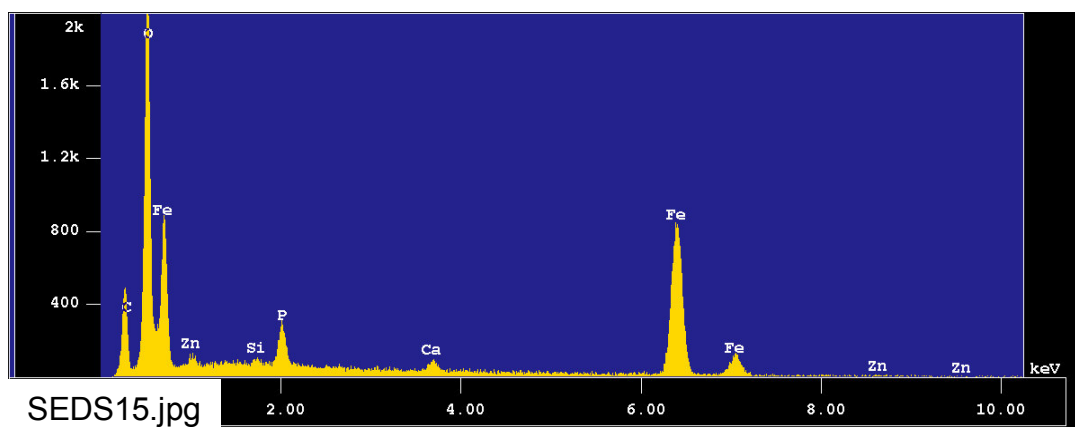
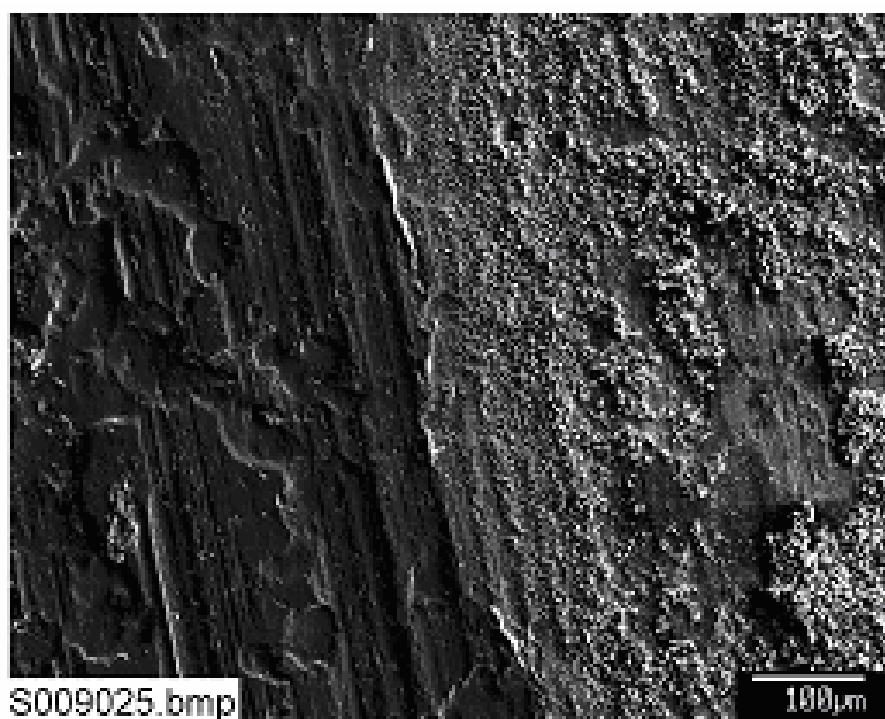


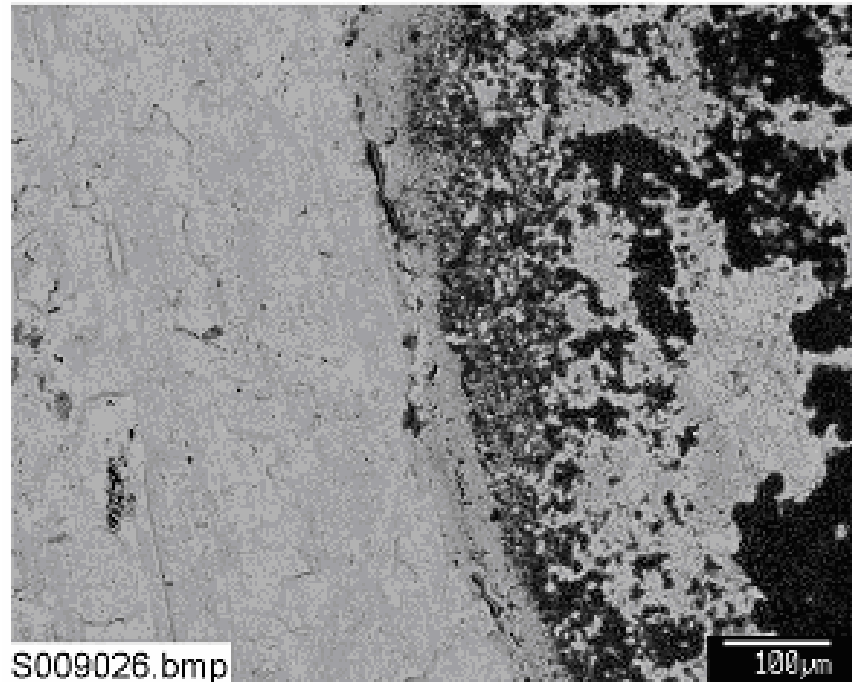
Figure C4-19. EDS counting spectrum for the dark grey spot (EDS-14) shown in Figure C4-15 (SEDs14).



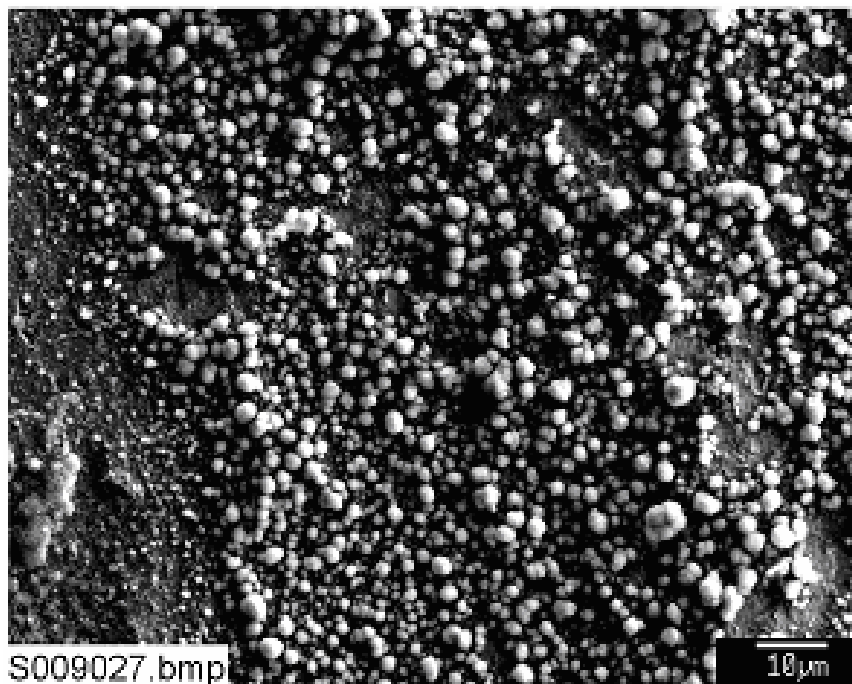
**Figure C4-20. EDS counting spectrum for the dark spot (EDS-15) shown in Figure C4-15 (SEDS15).**



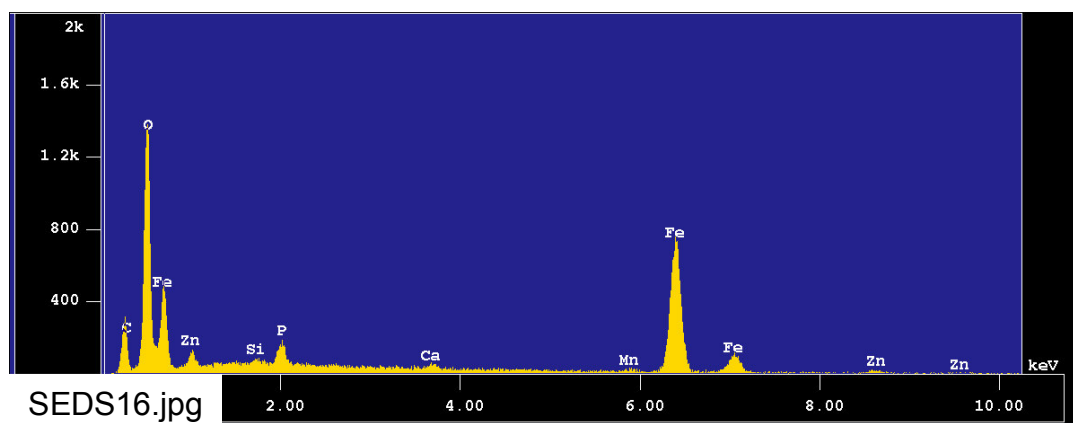
**Figure C4-21. SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009025). The image shows the interface between badly corroded (right) and less corroded surface (left).**



**Figure C4-22. Backscattered SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009026). It shows the same area as shown in Figure C4-21.**



**Figure C4-23. SEM image for a corroded area of a Test-2 Day-30 unsubmerged steel coupon (S009027).**



**Figure C4-24. EDS counting spectrum for a clump of round corrosion crystals shown in Figure C4-23 (SEDS16).**

This page is intentionally blank.