

## Appendix C3

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

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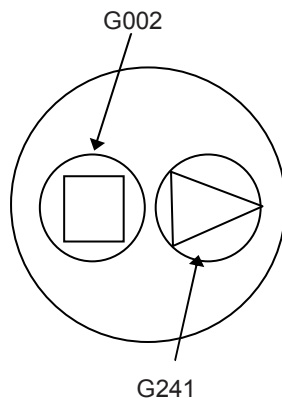
This appendix shows SEM/EDS results for the metal galvanized steel coupons in three different categories: (1) unused; (2) suspended or unsubmerged; and (3) submerged. *Unused* refers to the coupon condition before being subjected to ICET test conditions. *Suspended* or *unsubmerged* refers to coupons located above the water level of the solution during ICET tests. Suspended coupons contacted the solution only during the 4-hour spraying 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 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 galvanized 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 galvanized 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

Galvanized Steel Samples



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

Metal	Sample	Test
Galvanized Steel:	G002	Unused G002
	G241	Test 1 Unsubmerged G241
	G332	Test 1 Submerged G332
	G334	Test 2 Submerged G334
	G390	Test 2 Unsubmerged G390

Note: All samples were carbon coated.

Results for Test 1 samples G241 and G332 are provided in the Test #1 summary data report.

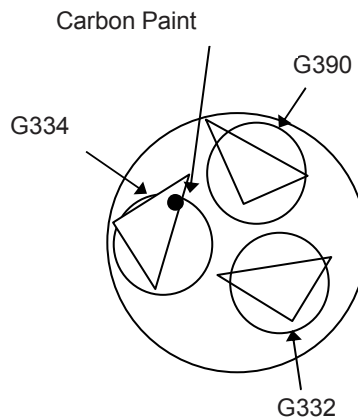
### Sample G002 Unused Galvanized Steel

Image:	G002031	40 ×	SEI overview	Figure C3-1
	G002032	150 ×	SEI different area	Figure C3-2
	G002033	1000 ×	SEI same area	Figure C3-3
	G002034	1000 ×	BEI same area	Figure C3-4
EDS:	GEDS20		Smooth zinc surface	Figure C3-5
	GEDS21		Small circular spots in zinc (image 034)	Figure C3-6
	GEDS22		Bright spots in zinc	Figure C3-7



Laboratory session from April 4, 2005

## Galvanized Steel Samples (Continued)



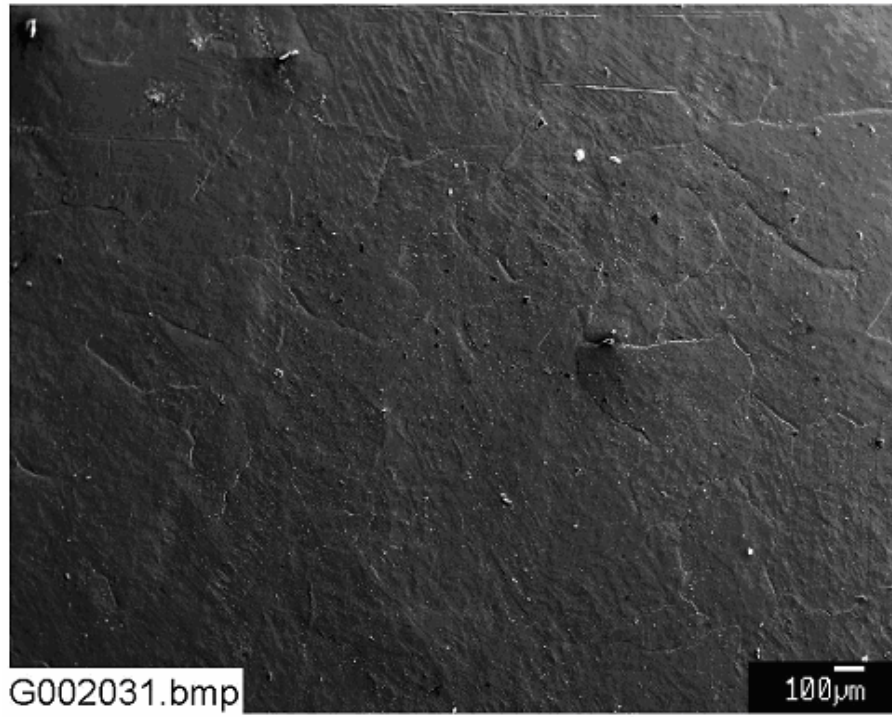
Conditions: 15-kV, 1-nA beam current, Aperture = 2

### Sample G334 Test #2 Submerged Galvanized Steel

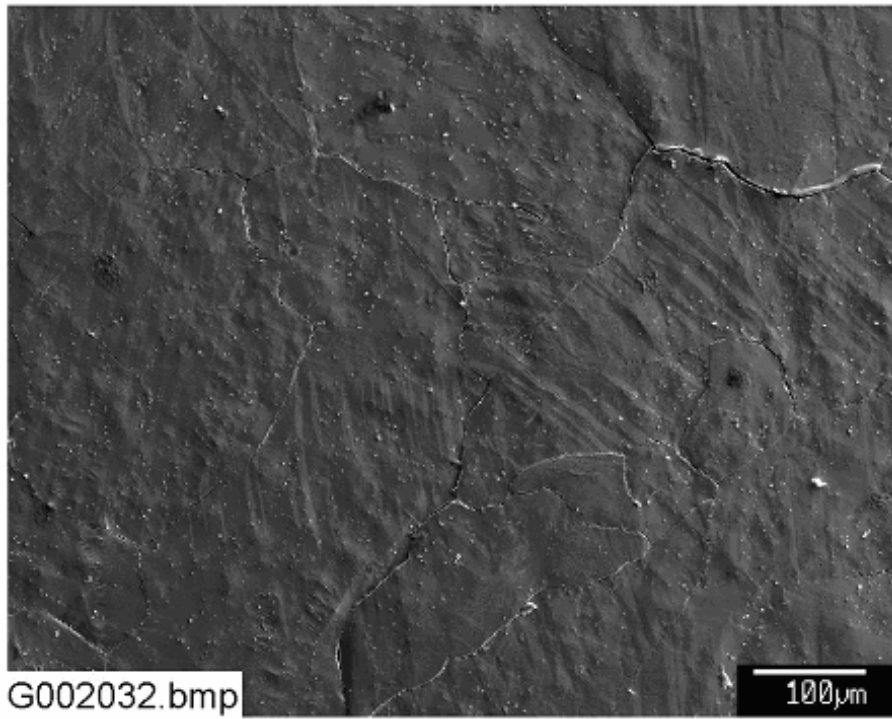
Image:	G334048	40 ×	On corroded surface	Figure C3-8
	G334049	150 ×	SEI on corroded surface	Figure C3-9
	G334050	150 ×	BEI on corroded surface	Figure C3-10
EDS:	GEDS29		EDS on fiberlike crystals on T2D30 submerged G-Steel	Figure C3-11
Image:	G334051	1000 ×		Figure C3-12

### Sample G390 Test #2 Unsubmerged Galvanized Steel

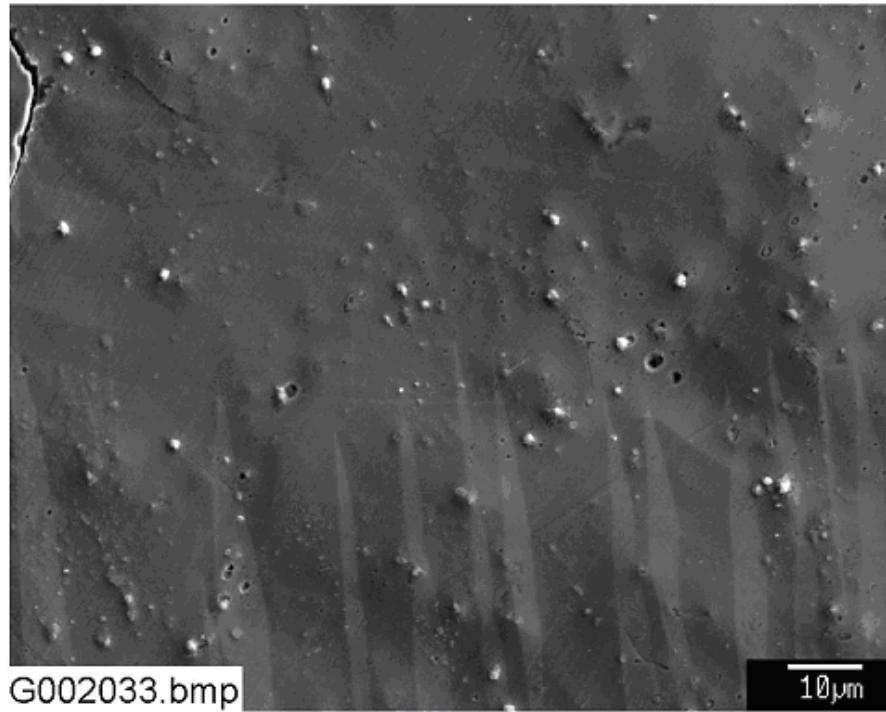
Image:	G390044	40 ×	overview of surface	Figure C3-13
	G390045	150 ×	SEI same as above	Figure C3-14
	G390046	150 ×	BEI same as above	Figure C3-15
EDS:	GEDS27		EDS on dark spot T2D30 unsubmerged G-steel	Figure C3-16
	GEDS28		EDS on light surface of T2D30 unsubmerged G-steel	Figure C3-17
Image:	G390047	1000 ×	SEI on corroded surface	Figure C3-18



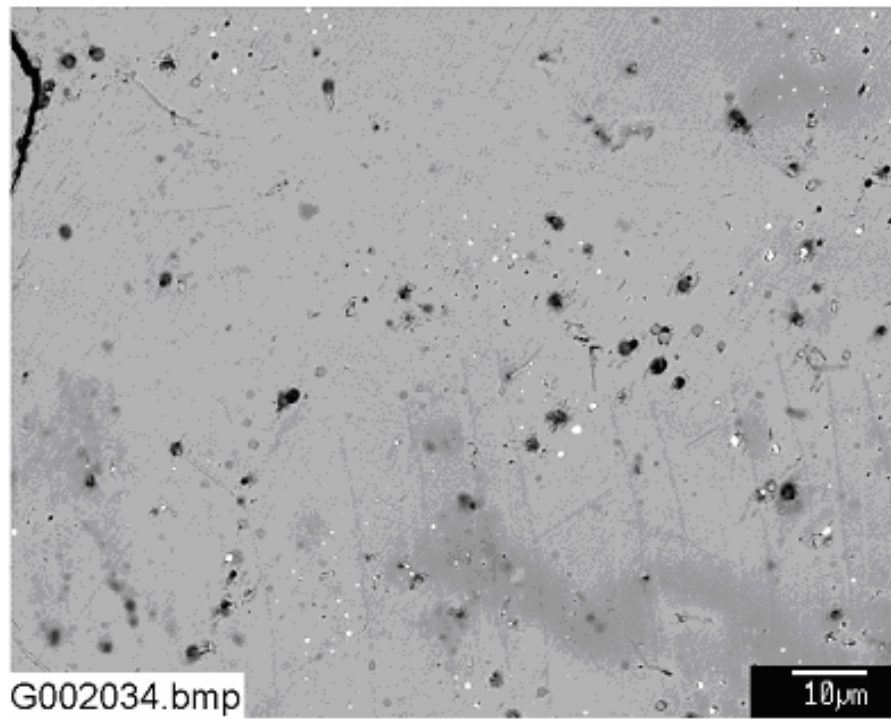
**Figure C3-1. SEM image for an unused galvanized steel coupon (G002031).**



**Figure C3-2. SEM image for an unused galvanized steel coupon (G002032).**



**Figure C3-3. SEM image for an unused galvanized steel coupon (G002033).**



**Figure C3-4. Backscattered SEM image for an unused galvanized steel coupon (G002034).**

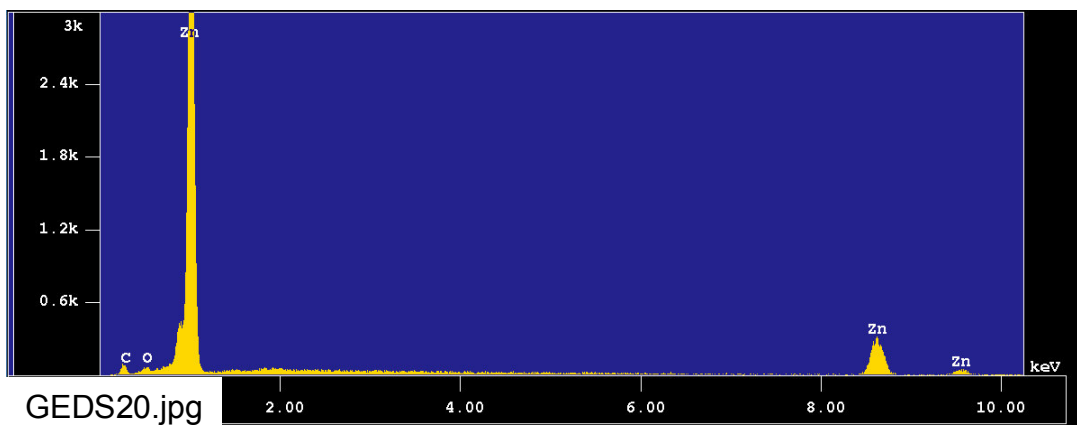


Figure C3-5. EDS counting spectrum for smooth zinc surface (GEDS20).

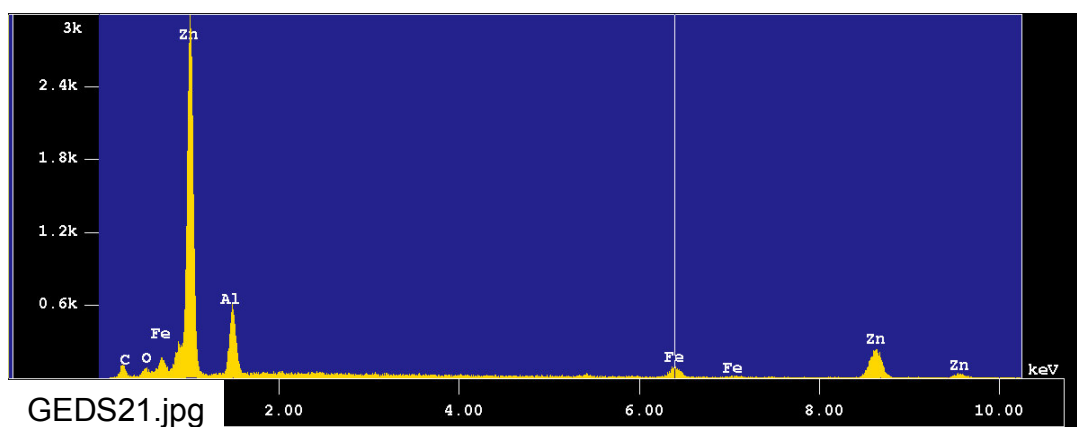


Figure C3-6. EDS counting spectrum for the small dark circular spots shown in Figure C3-4 (GEDS21).

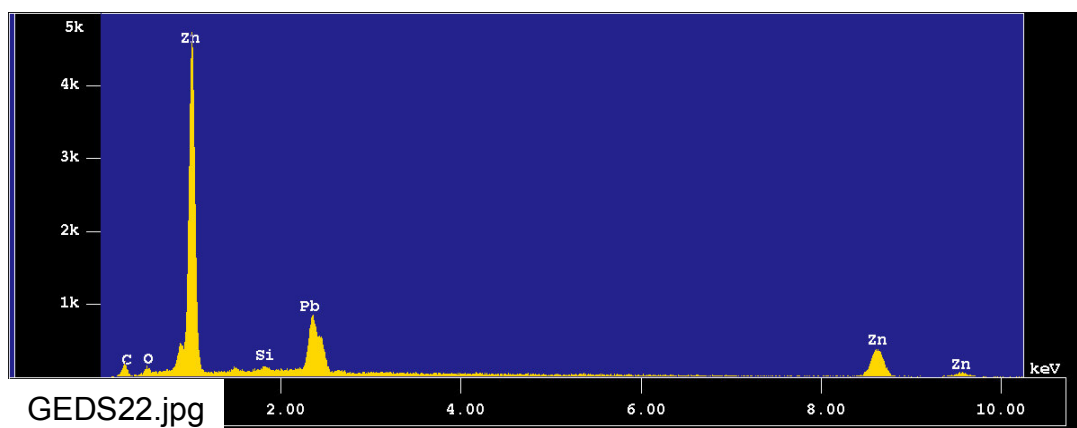
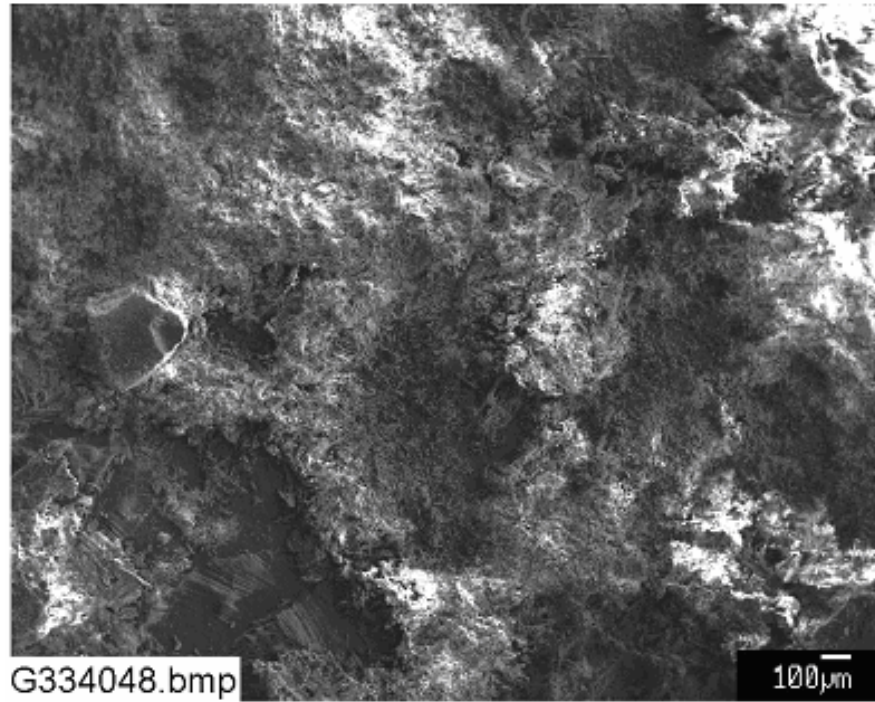
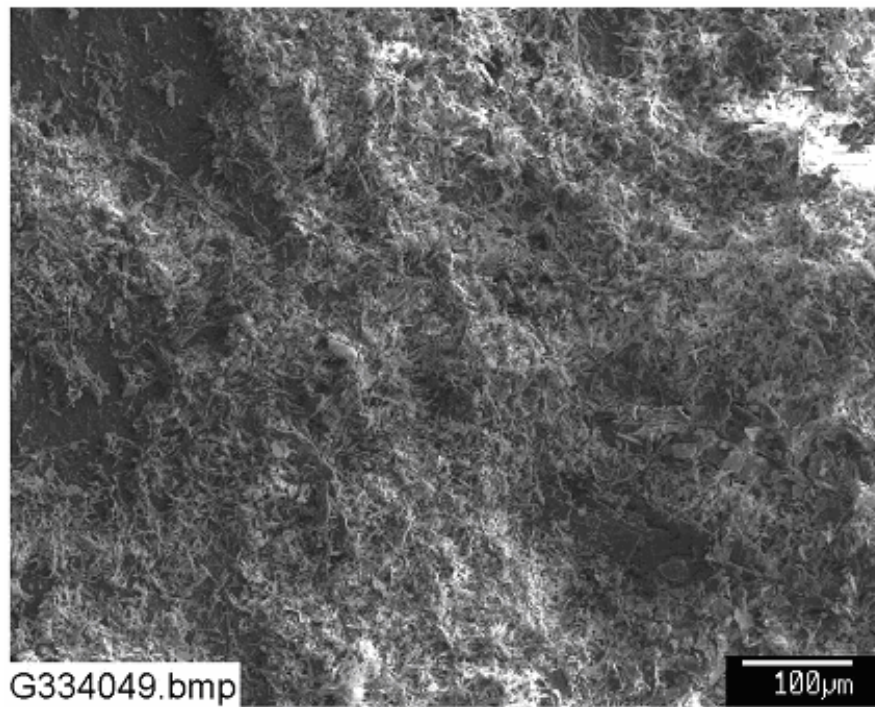


Figure C3-7. EDS counting spectrum for the bright spots shown in Figure C3-4 (GEDS22).

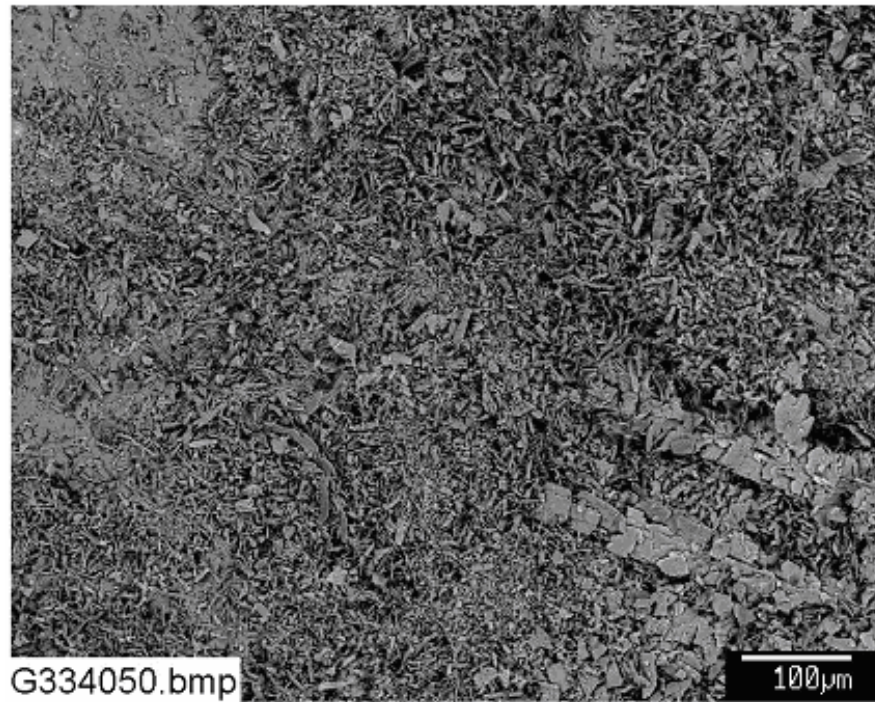


**Figure C3-8. SEM image for a Test-2 Day-30 submerged galvanized steel coupon (G334048).**

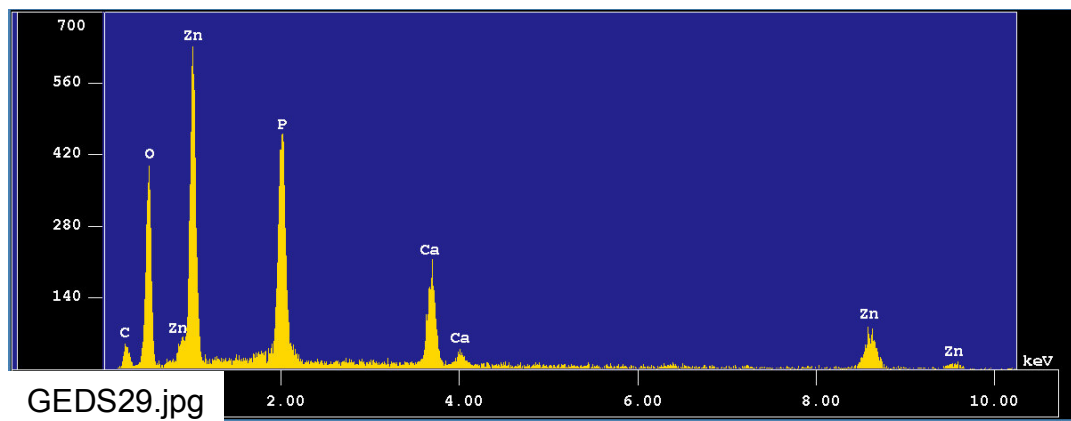


**Figure C3-9: SEM image for a Test-2 Day-30 submerged galvanized steel coupon (G334049).**

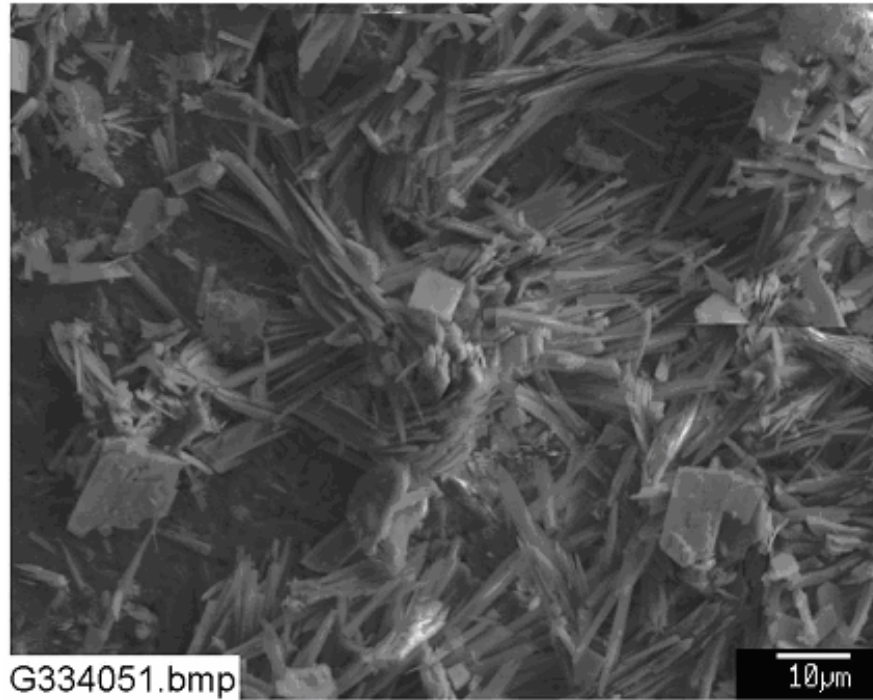




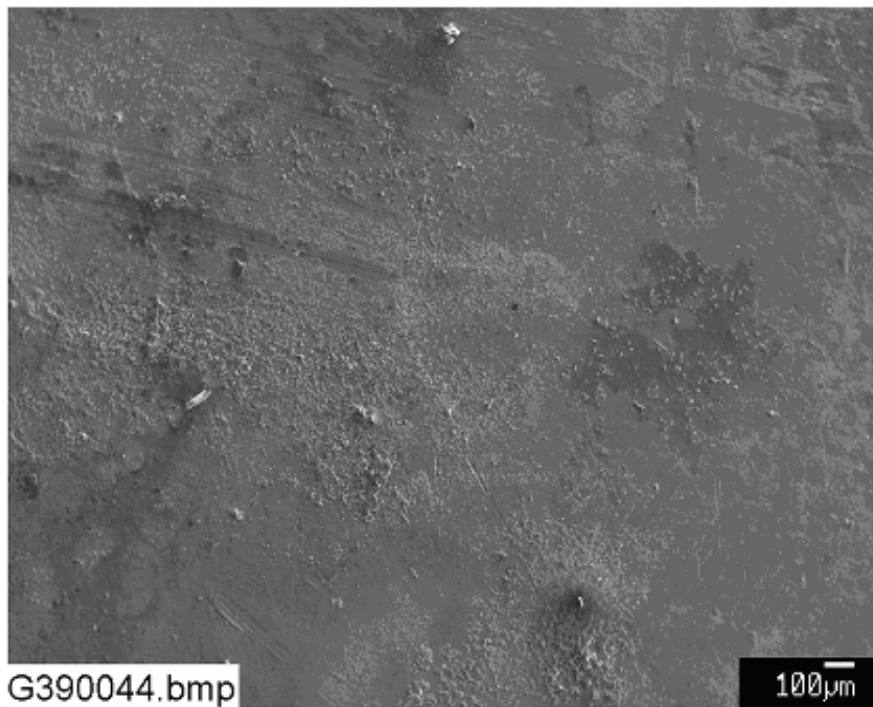
**Figure C3-10. Backscattered SEM image for a Test-2 Day-30 submerged galvanized steel coupon (G334050).**



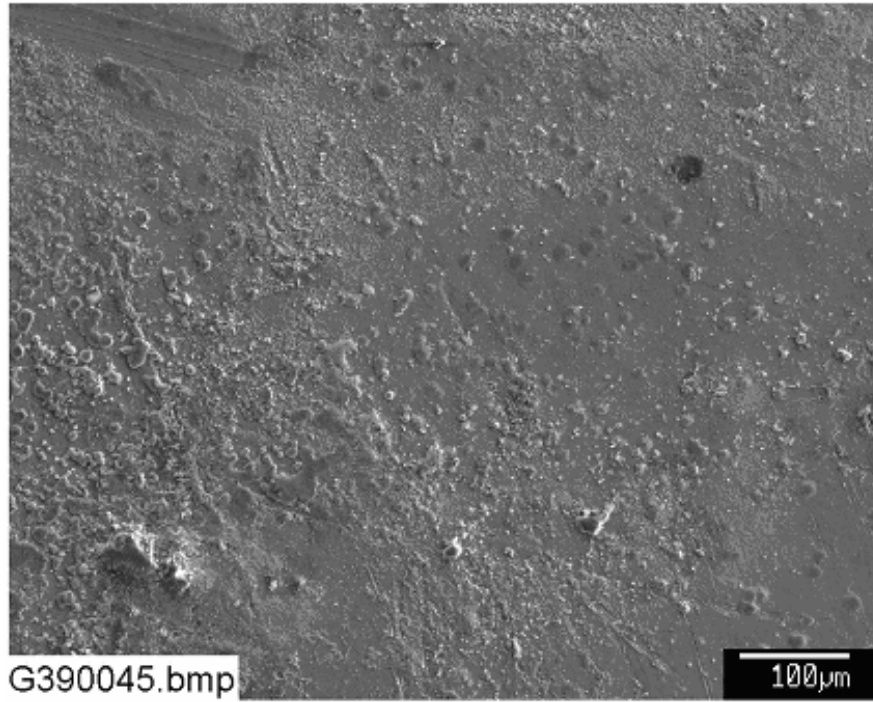
**Figure C3-11. EDS counting spectrum on fiberlike crystals shown in Figure C3-10 (GEDS29).**



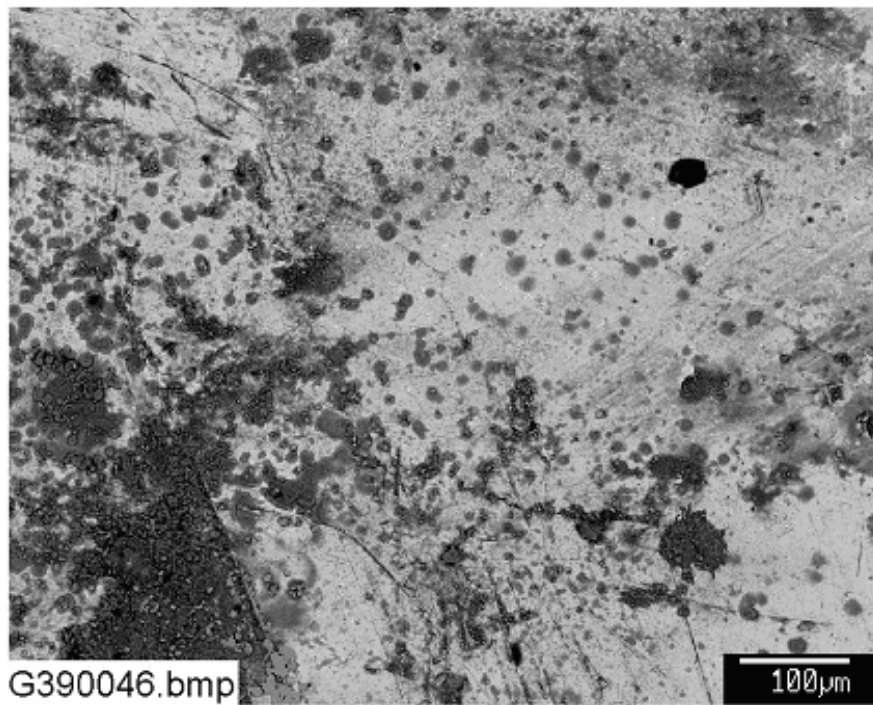
**Figure C3-12. SEM image for a Test-2 Day-30 submerged galvanized steel coupon (G334051).**



**Figure C3-13. SEM image for a Test-2 Day-30 unsubmerged galvanized steel coupon (G390044).**

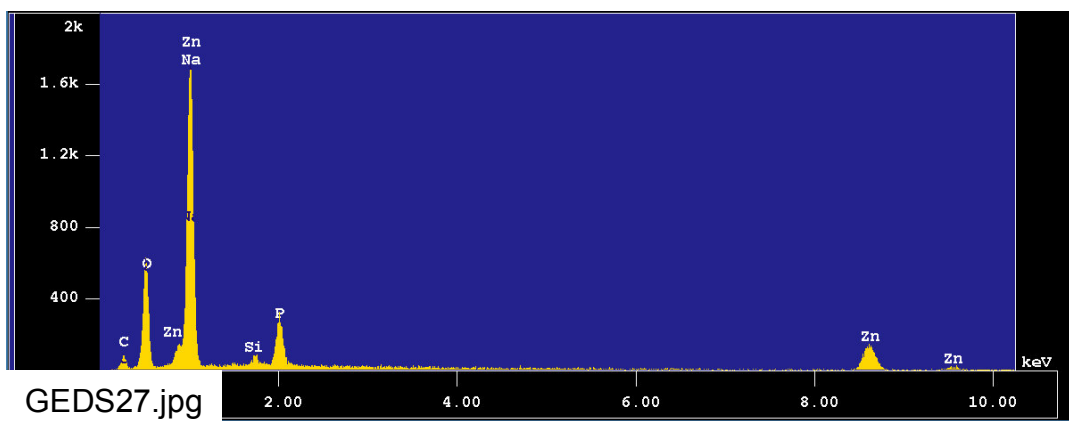


**Figure C3-14. SEM image for a Test-2 Day-30 unsubmerged galvanized steel coupon (G390045).**



**Figure C3-15. Backscattered SEM image for a Test-2 Day-30 unsubmerged galvanized steel coupon (G390046).**





**Figure C3-16. EDS counting spectrum on the dark spots shown in Figure C3-15 (GEDS27).**

The results from the chemical composition analysis for GEDS27 are given in Table C3-1.

**Table C3-1. The Chemical Compositions for GEDS27**

Apr 4 11:16 2005 /tmp/eds\_pout.log Page 1

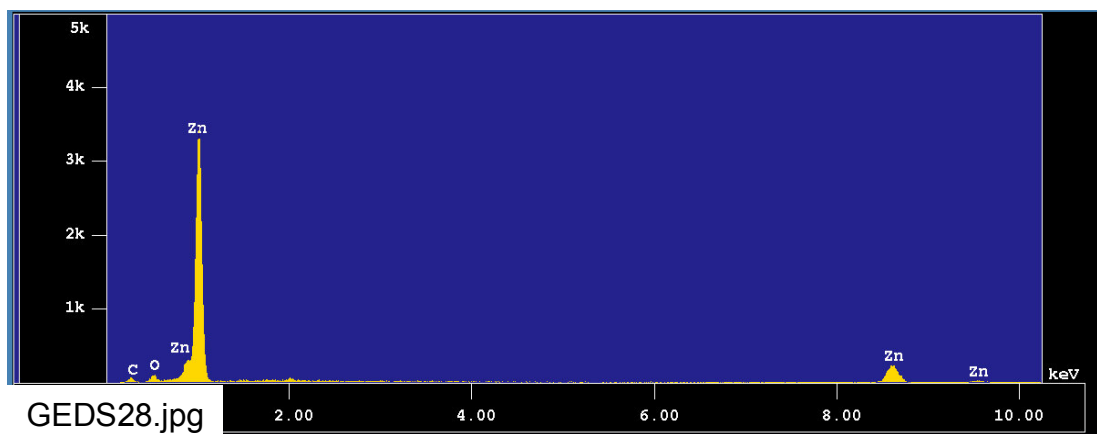
Group : NRC  
Sample : Metals ID# : 27  
Comment : Darkspot on T2D30 unsubmged bsce G-Steel  
Condition : Full Scale : 20KeV(10eV/ch,2Kch)  
Live Time : 60.000 sec Aperture # : 1  
Acc. Volt : 15.0 KV Probe Current : 8.078E-10 A  
Stage Point : X=70.816 Y=58.930 Z=11.000  
Acq. Date : Mon Apr 4 11:09:30 2005

Element	Mode	ROI (KeV)	K-ratio(%)	+/-	Net/Background	
O K	Normal	0.25- 0.77	21.2528	0.0030	4018 /	68
Na K	Normal	0.81- 1.27	0.0000	0.0000	0 /	50
Si K	Normal	1.50- 2.05	0.6880	0.0003	503 /	96
P K	Normal	1.75- 2.38	5.9416	0.0032	2683 /	57
Zn K	Normal	8.22-10.03	45.8600	0.0111	2504 /	3

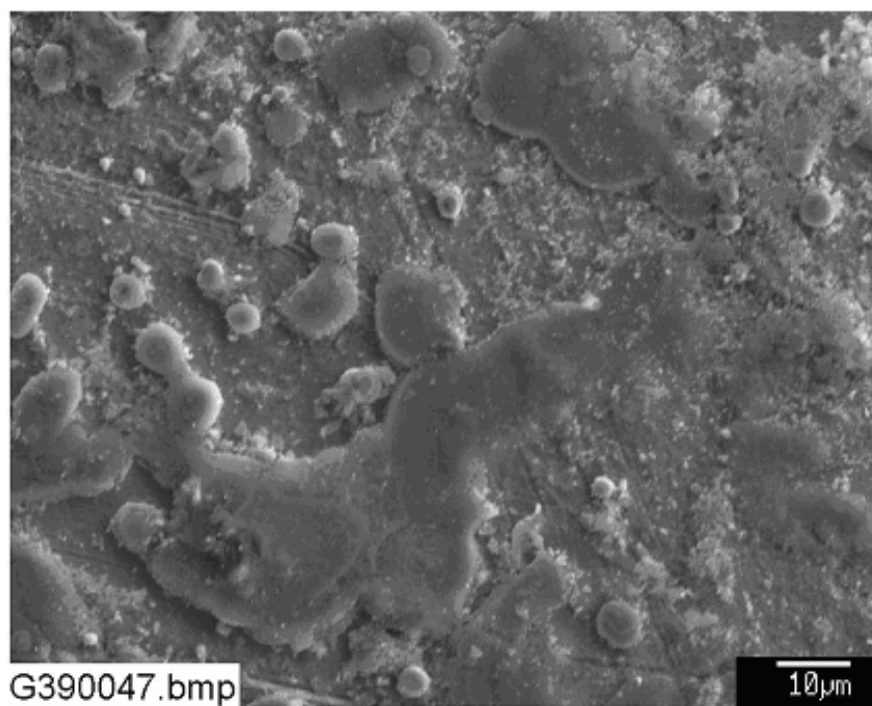
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Chi\_square = 49.4797

Element	Mass%	Atomic%	ZAF	Z	A	F
O	25.047	54.4632	0.9144	0.8736	1.0468	0.9999
Na	0.000	0.0000	2.3046	0.9205	2.5030	1.0002
Si	1.403	1.7380	1.5824	0.8740	1.8129	0.9987
P	7.881	8.8519	1.0292	1.0482	0.9818	1.0000
Zn	65.668	34.9468	1.1110	1.1123	0.9988	1.0000

-----  
Total 100.000 100.0000  
Normalization factor = 1.2889



**Figure C3-17. EDS counting spectrum on the light surface shown in Figure C3-15 (GEDS28).**



**Figure C3-18. SEM image at 1000× magnification for a Test-2 Day-30 unsubmerged galvanized steel coupon (G390047).**

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