

Appendix C4

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

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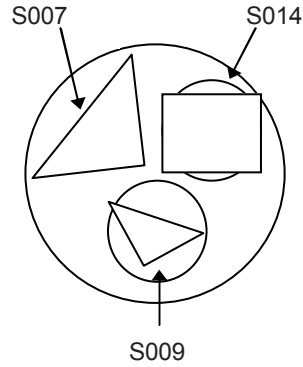
This appendix shows SEM/EDS results for the metal steel coupons in three different categories: (1) unused; (2) suspended or unsubmerged; and (3) submerged. *Unused* refers to the coupon condition before being subjected to ICET test conditions. *Suspended* or *unsubmerged* refers to coupons located above 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 |

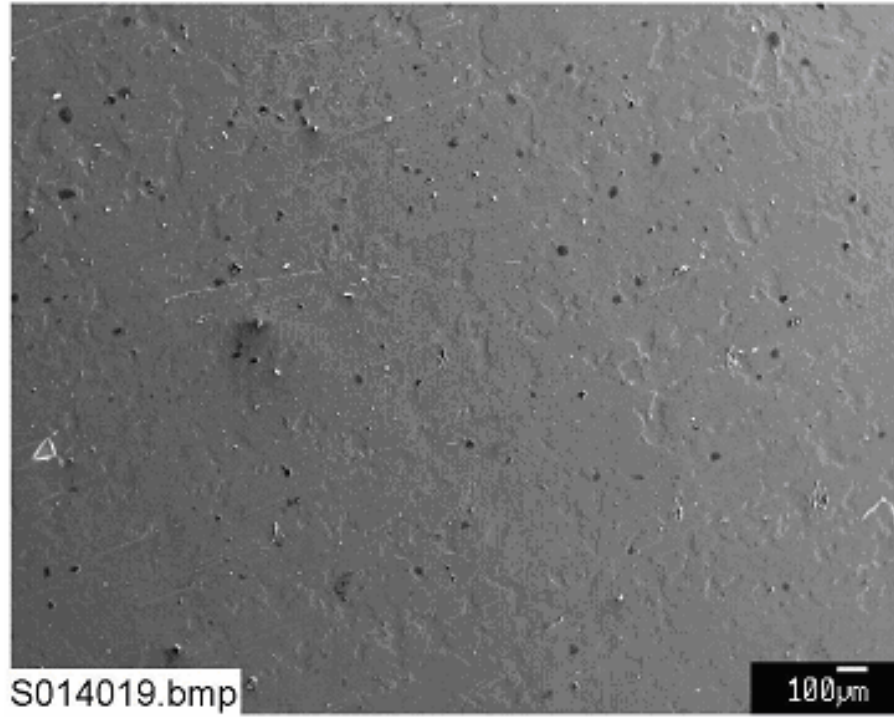


Figure C4-1. SEM image for an unused steel coupon (S014019).

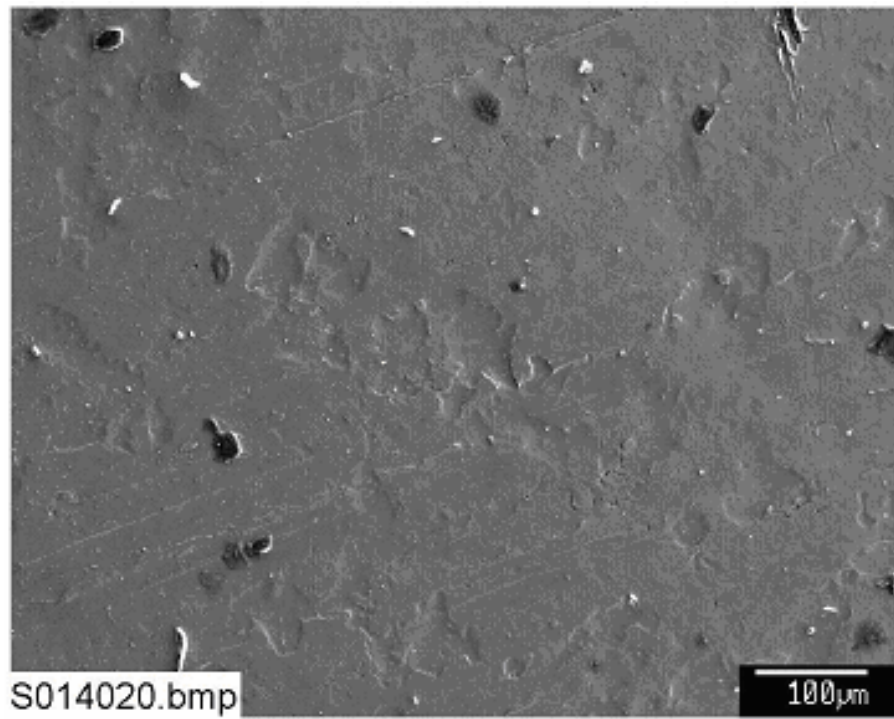


Figure C4-2. SEM image for an unused steel coupon (S014020).

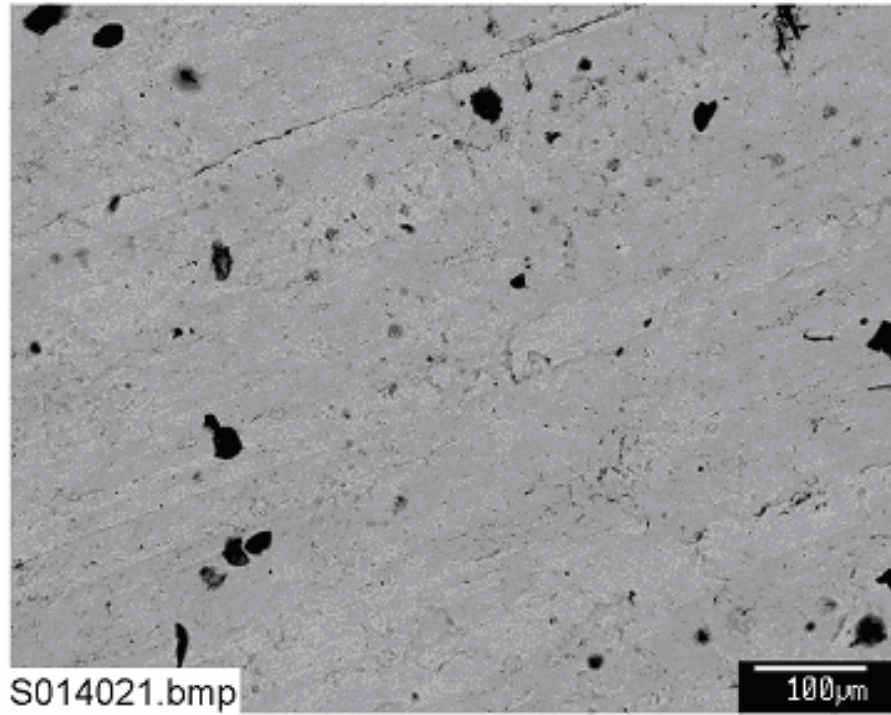


Figure C4-3. Backscattered SEM image for an unused steel coupon (S014021).

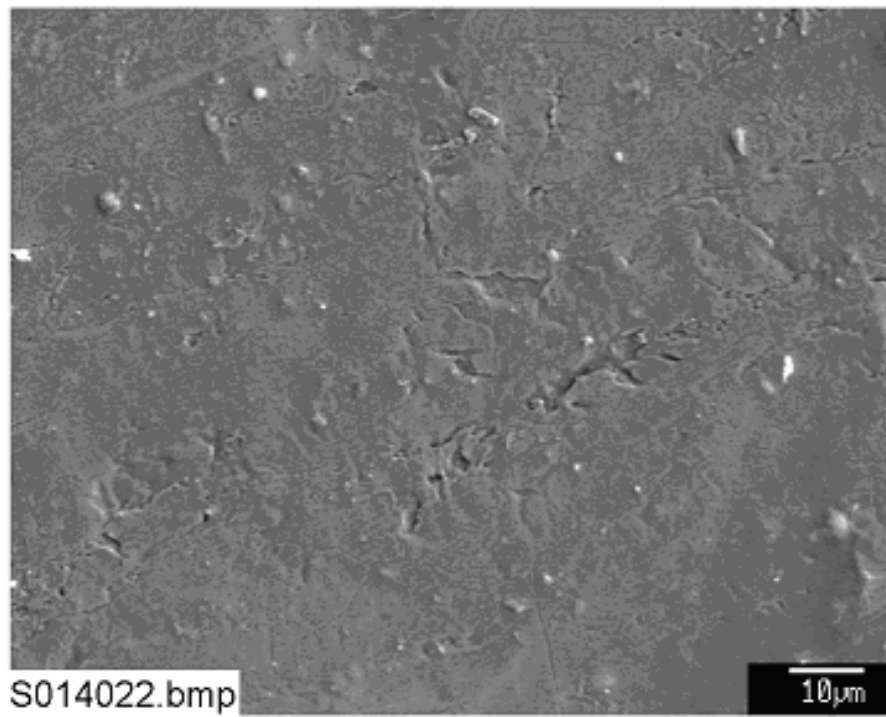


Figure C4-4. SEM image for an unused steel coupon (S014022).

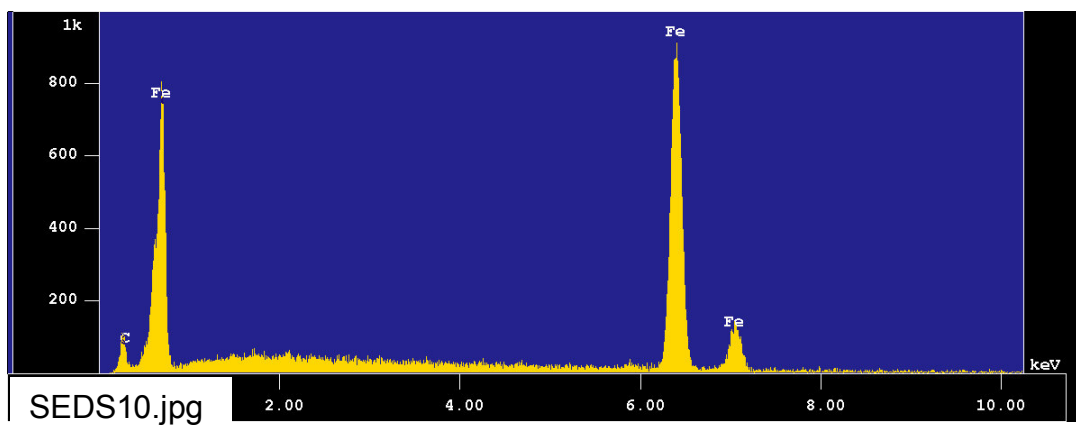


Figure C4-5. EDS counting spectrum for the steel surface shown in Figure C4-4 (SEDS10).

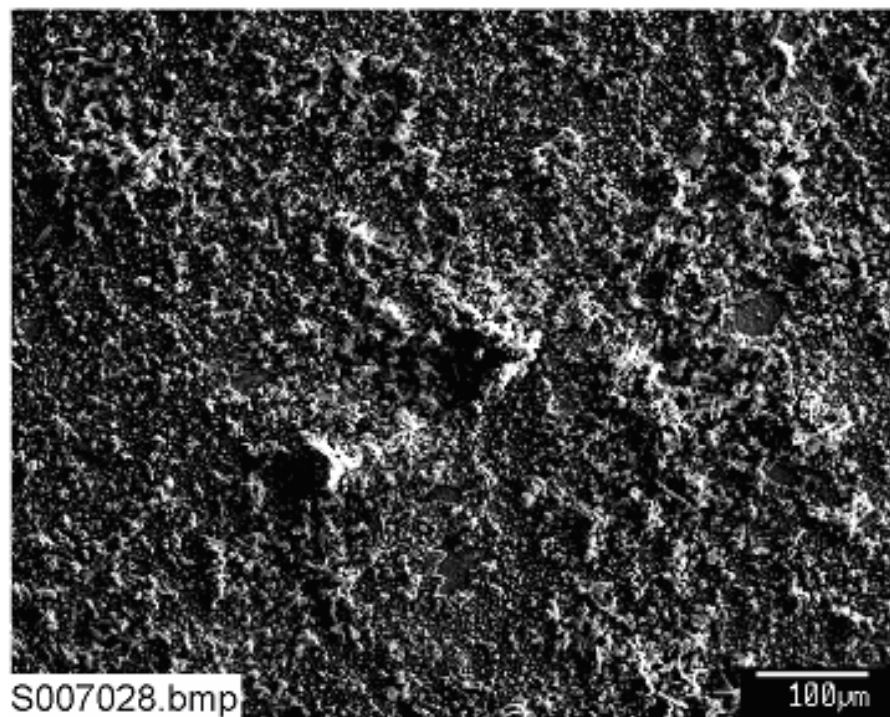


Figure C4-6. SEM image for a Test-2 Day-30 submerged steel coupon (S007028).

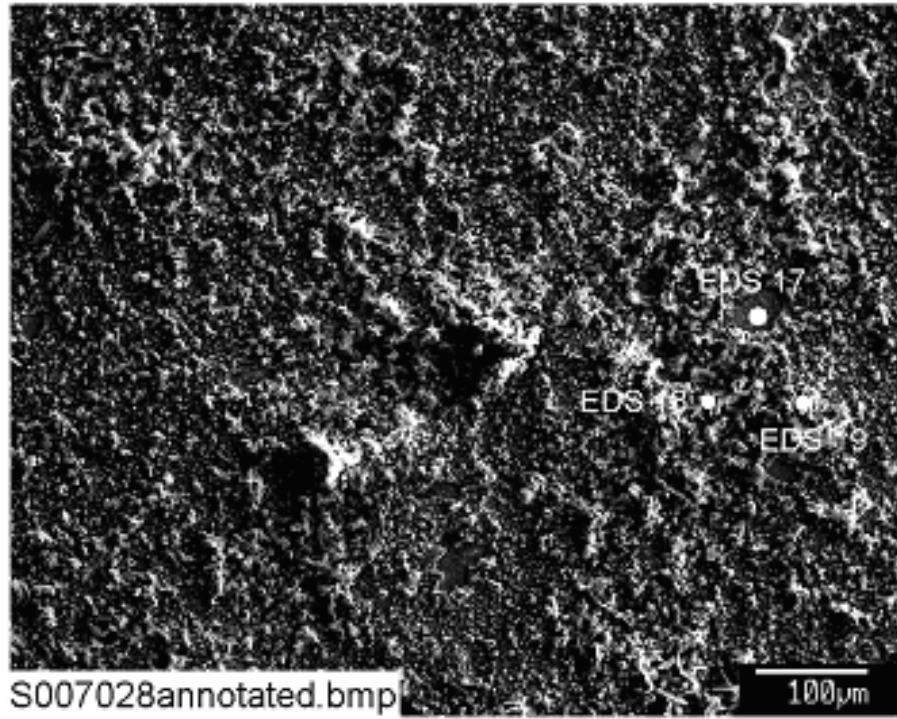


Figure C4-7. SEM image for the corrosion surface of a Test-2 Day-30 submerged steel coupon (S007028annotated).

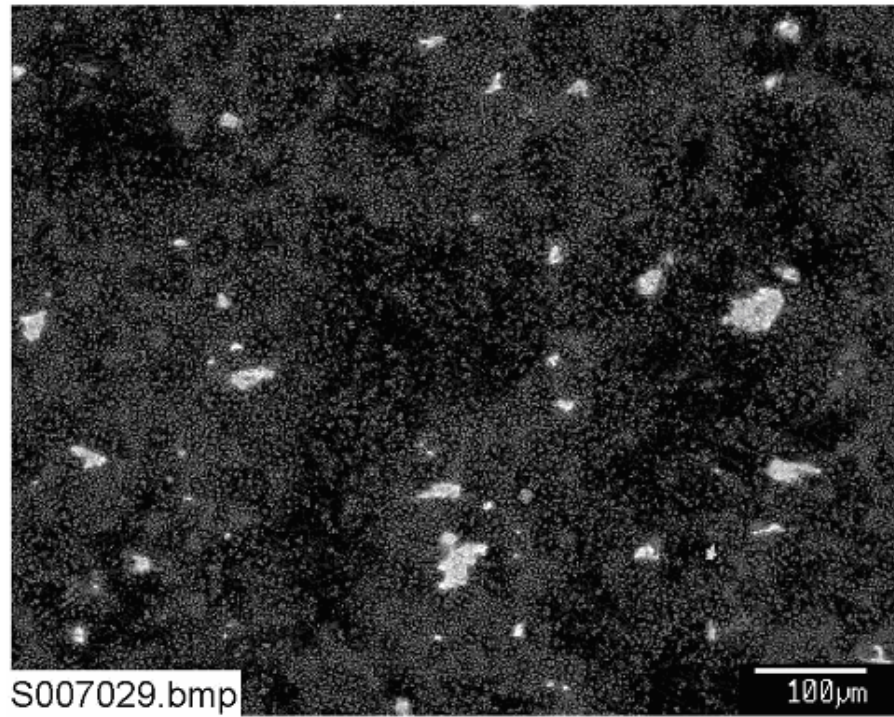


Figure C4-8. Backscattered SEM image for a Test-2 Day-30 submerged steel coupon (S007029).

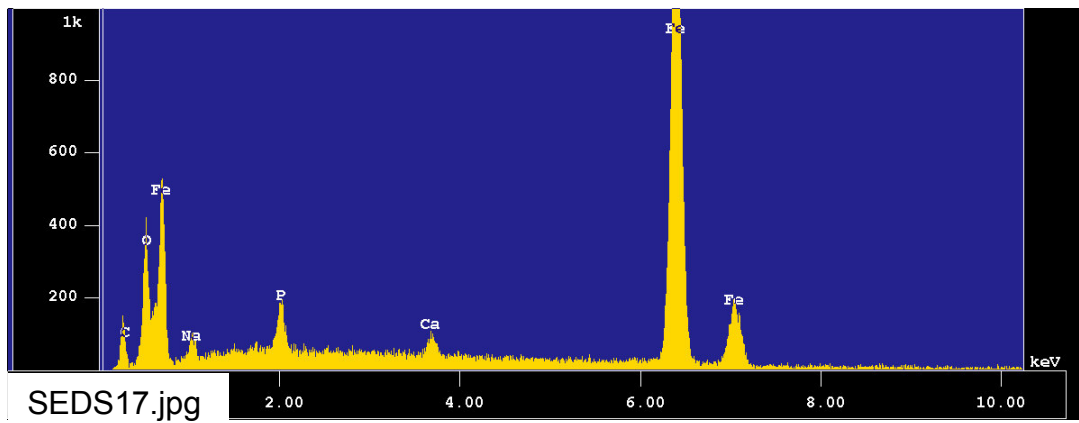


Figure C4-9. EDS counting spectrum for the light spot shown in Figure C4-8 (SEDs17).

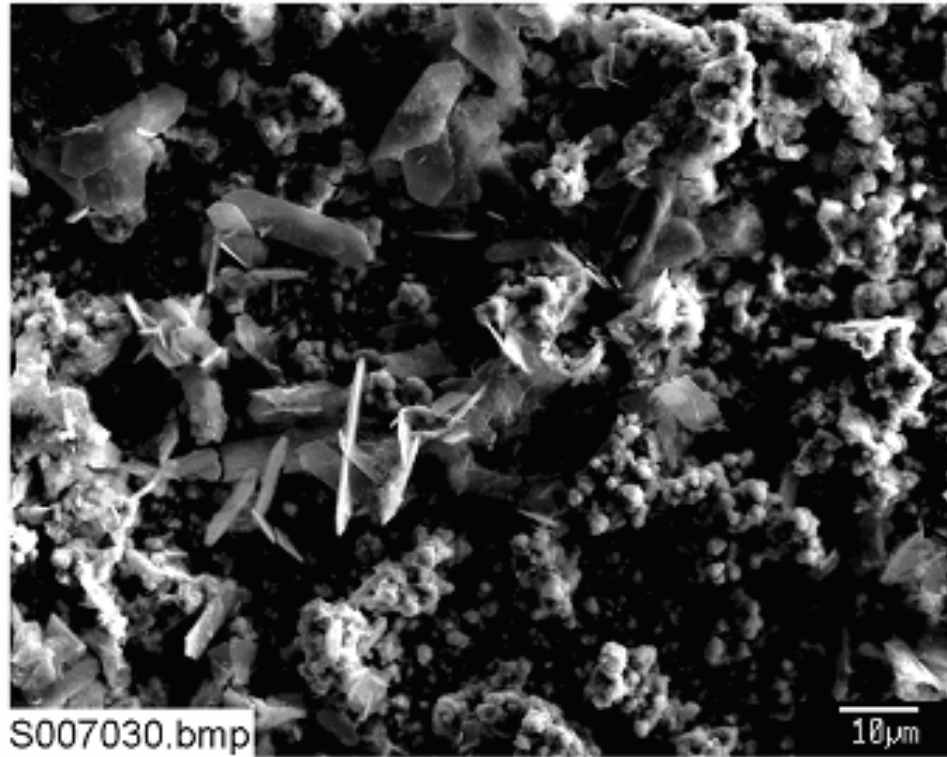


Figure C4-10. SEM image for the corrosion surface of a Test-2 Day-30 submerged steel coupon (S007030).

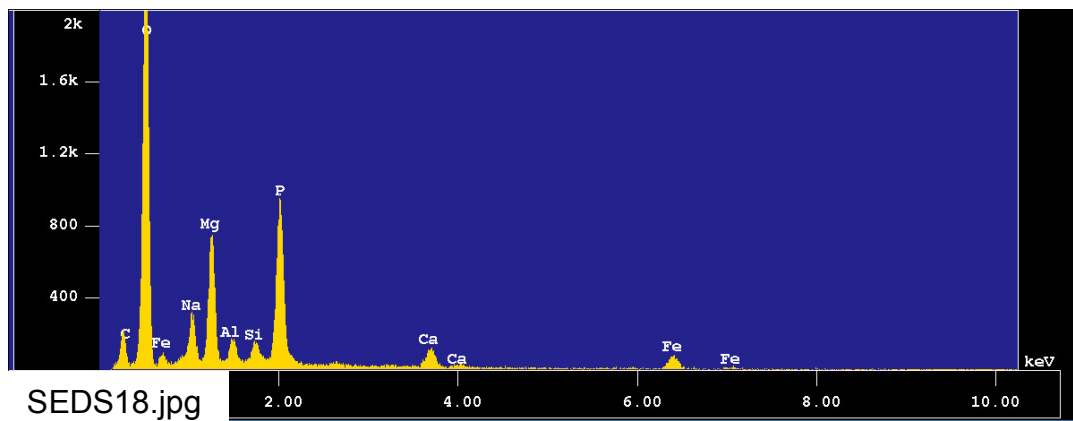


Figure C4-11. EDS counting spectrum for the thin crystals shown in Figure C4-10 (SEDS18).

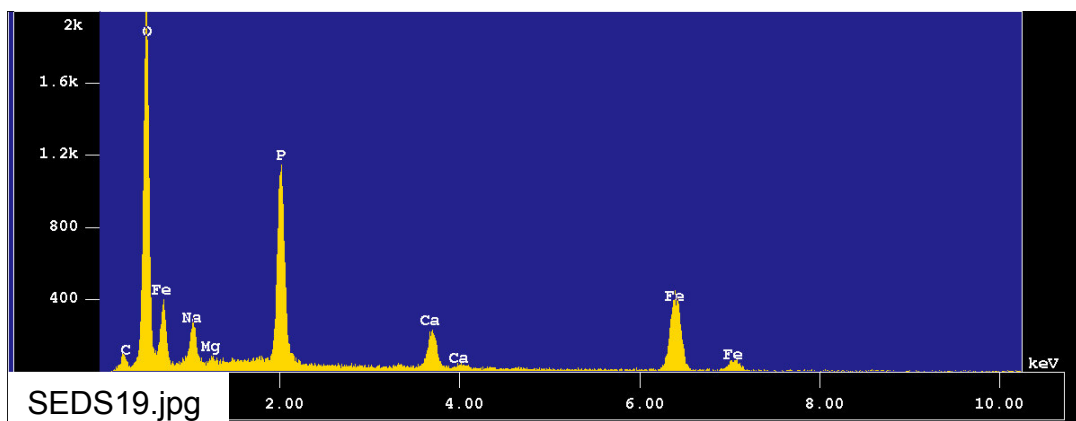


Figure C4-12. EDS counting spectrum for the clumps surrounding crystals shown in Figure C4-10 (SEDS19).

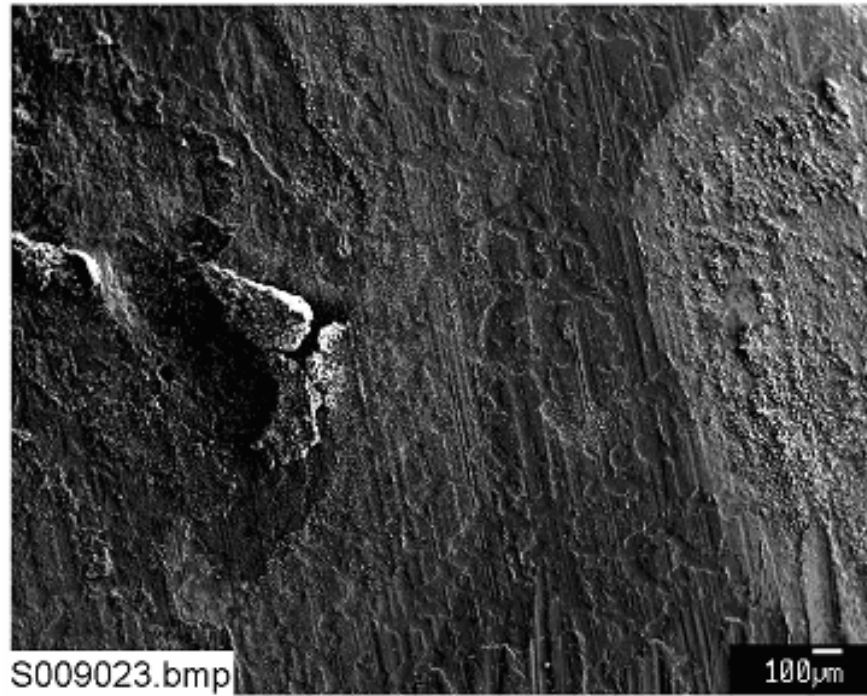


Figure C4-13. SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009023).

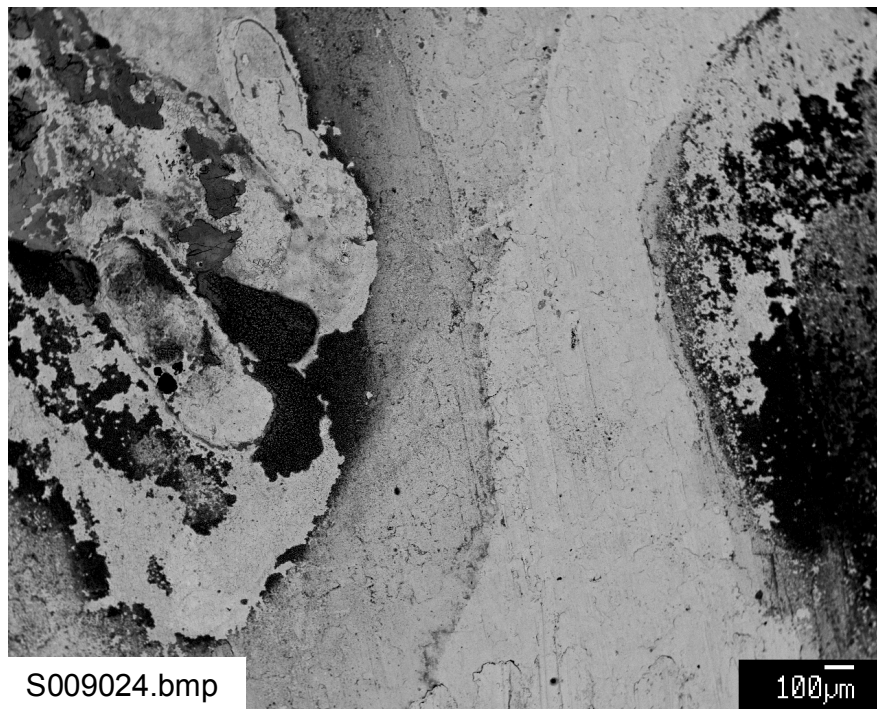


Figure C4-14. Backscattered SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009024).

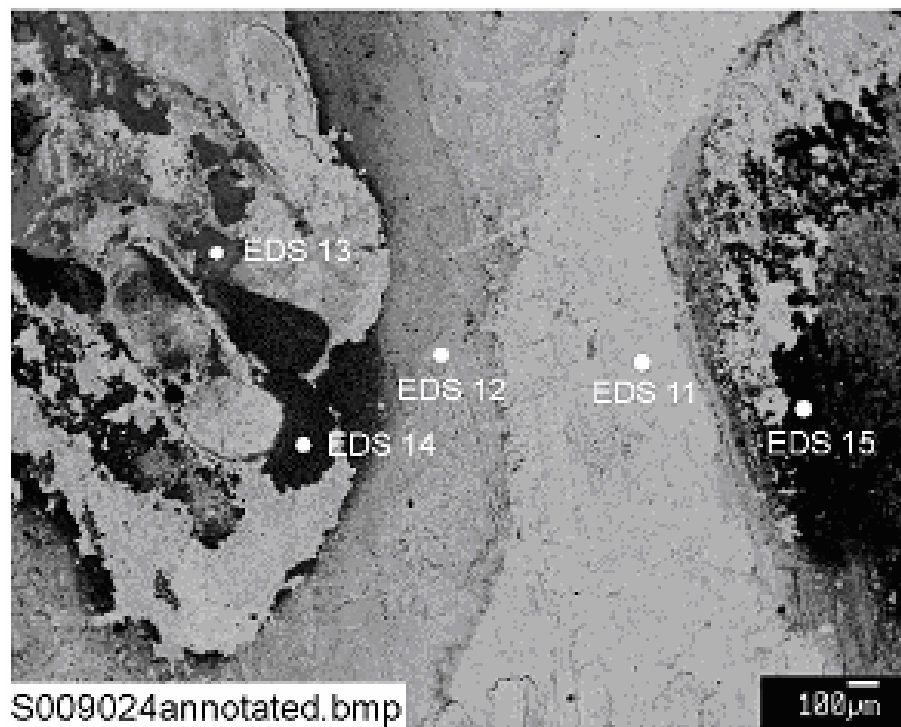


Figure C4-15. Annotated backscattered SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009024annotated).

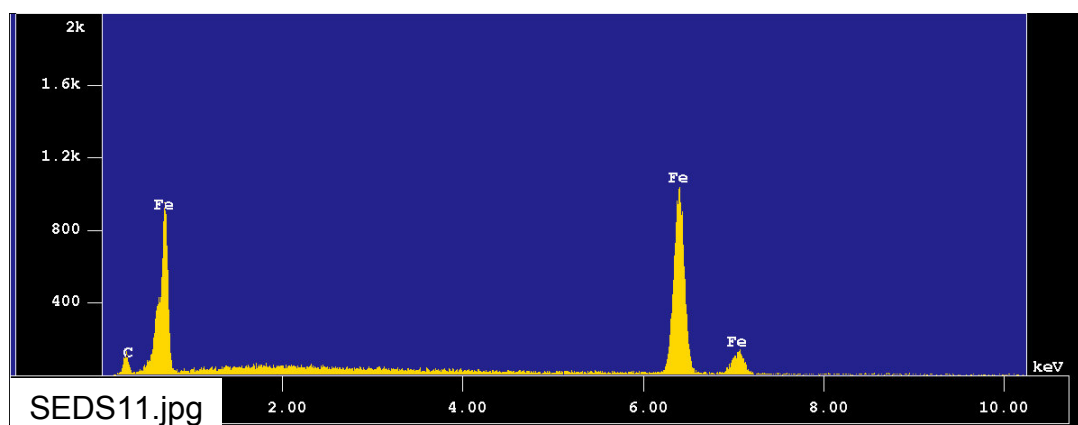


Figure C4-16. EDS counting spectrum for the light streak (EDS-11) shown in Figure C4-15 (SEDS11).

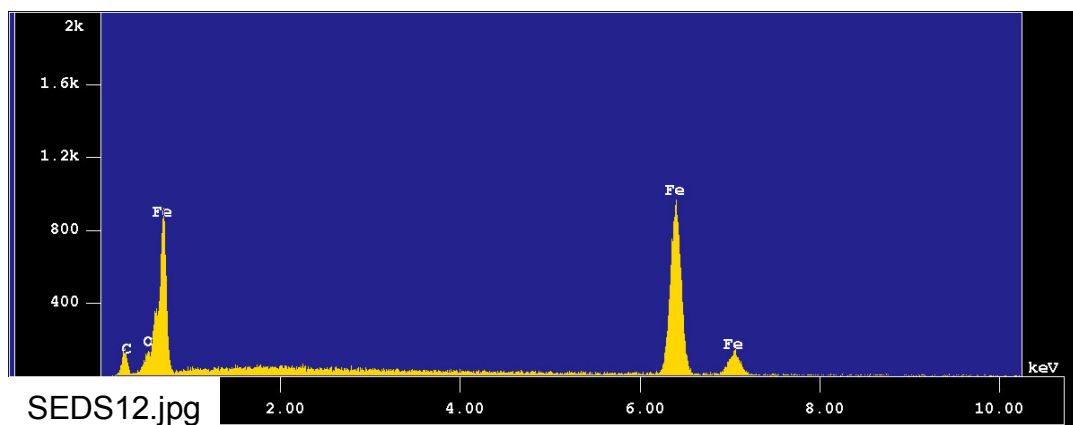


Figure C4-17. EDS counting spectrum for the light grey streak (EDS-12) shown in Figure C4-15 (SEDs12).

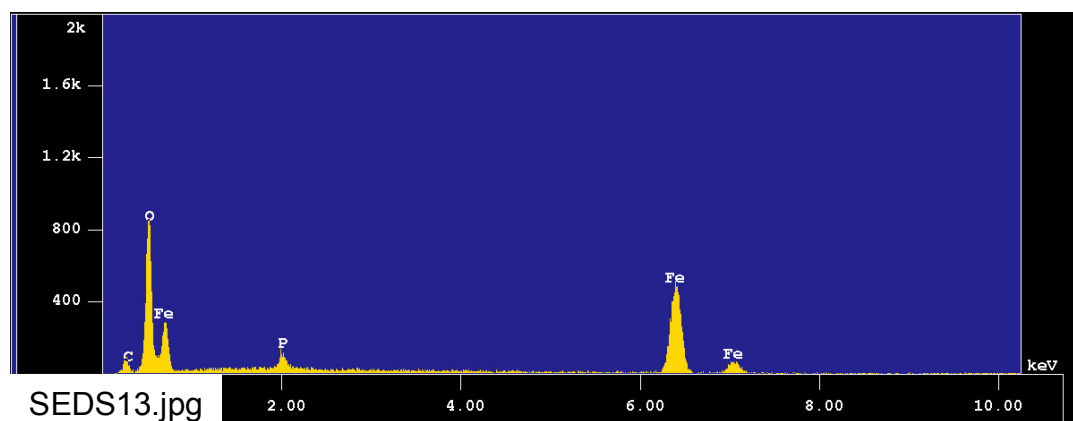


Figure C4-18. EDS counting spectrum for the medium grey spot (EDS-13) shown in Figure C4-15 (SEDs13).

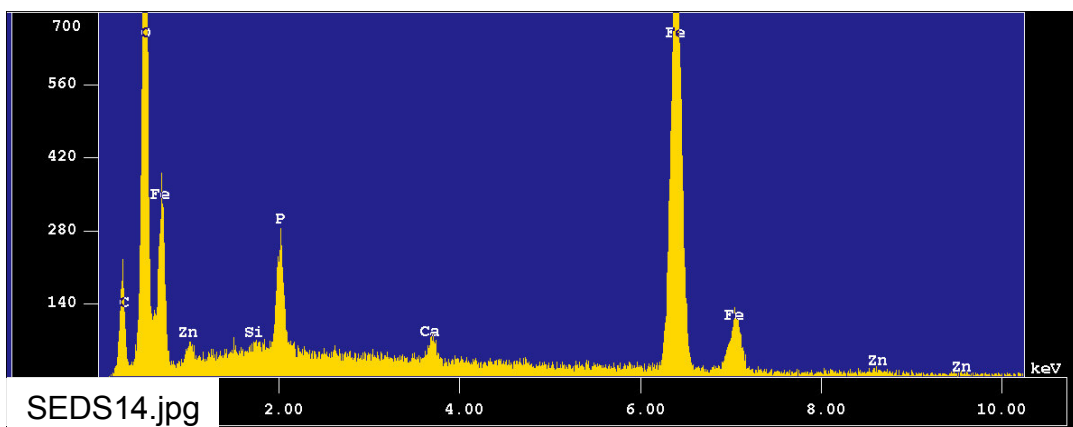


Figure C4-19. EDS counting spectrum for the dark grey spot (EDS-14) shown in Figure C4-15 (SEDs14).

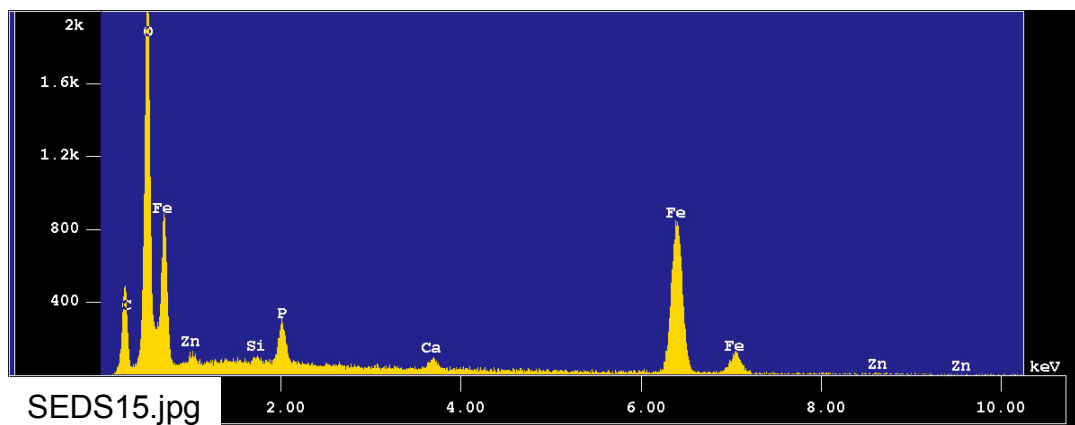


Figure C4-20. EDS counting spectrum for the dark spot (EDS-15) shown in Figure C4-15 (SEDS15).

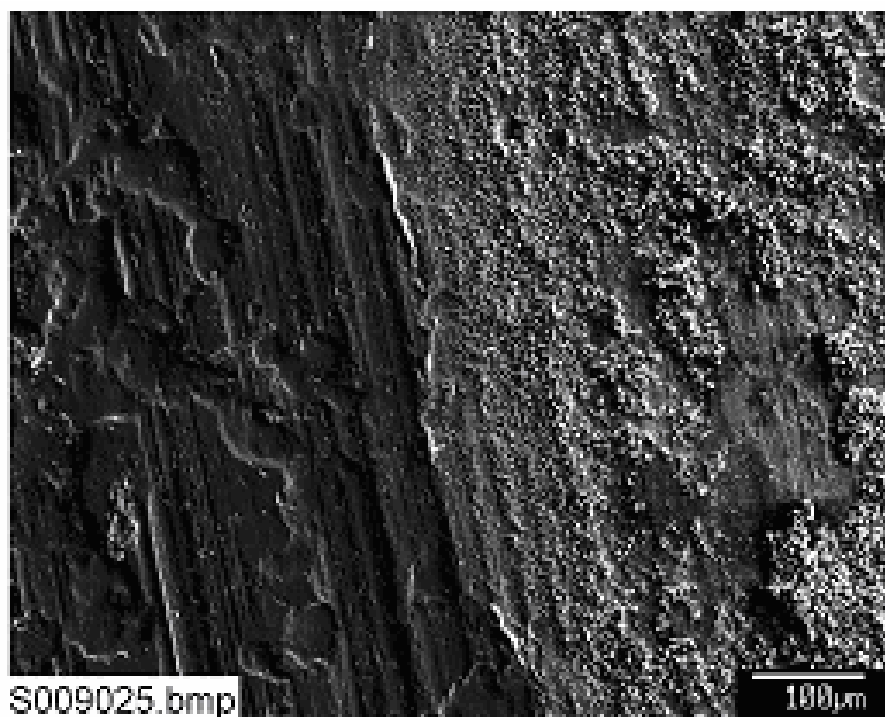


Figure C4-21. SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009025). The image shows the interface between badly corroded (right) and less corroded surface (left).

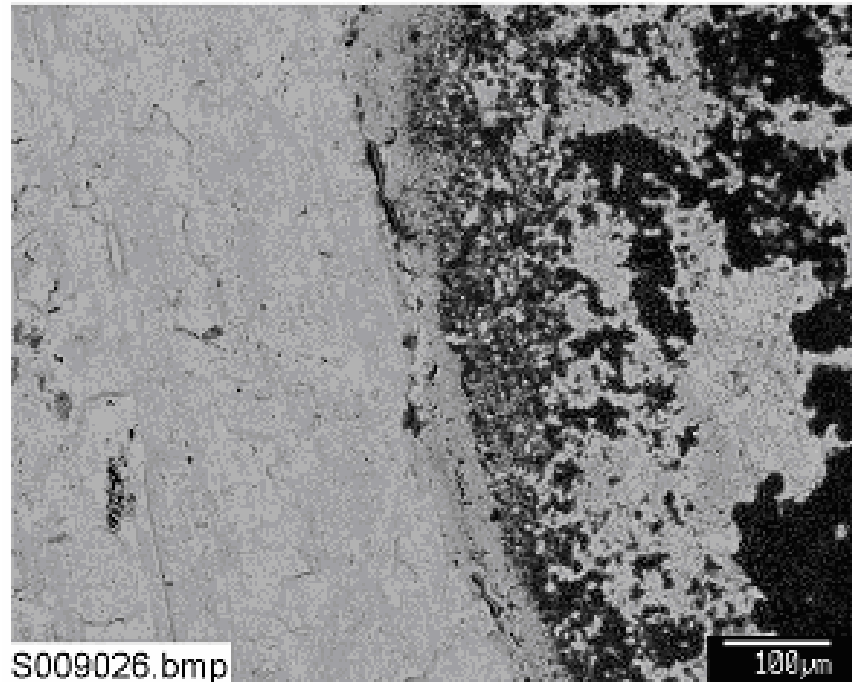


Figure C4-22. Backscattered SEM image for a Test-2 Day-30 unsubmerged steel coupon (S009026). It shows the same area as shown in Figure C4-21.

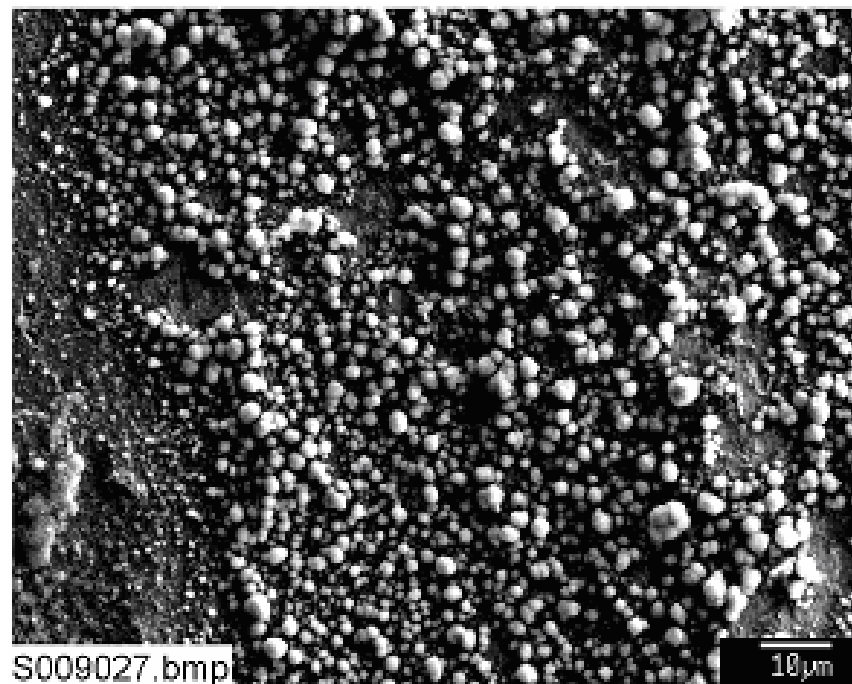


Figure C4-23. SEM image for a corroded area of a Test-2 Day-30 unsubmerged steel coupon (S009027).

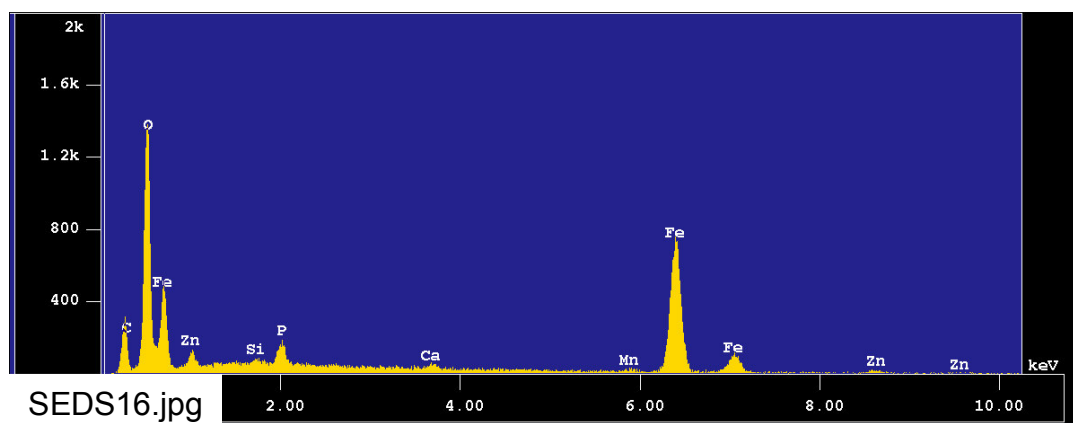


Figure C4-24. EDS counting spectrum for a clump of round corrosion crystals shown in Figure C4-23 (SEDS16).

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