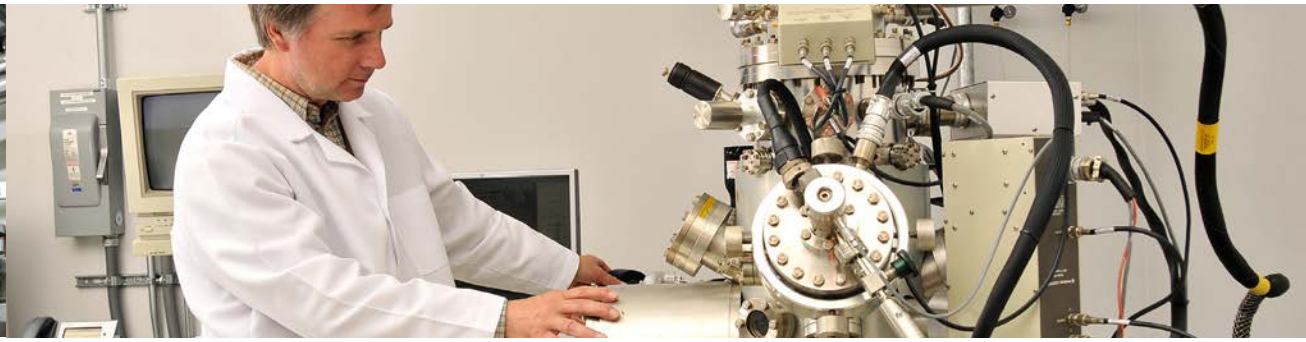


Evaluating Surface and Oxide Composition of Electropolished Stainless Steel for High-Purity Gas Distribution Systems

EAG Laboratories scientists have the scientific expertise and regulatory know-how to perform the assessments needed to evaluate the quality and efficiency of electropolishing and/or passivation of chromium-enriched stainless steel tubing, fittings, valves, and other components. These tests involve determining the surface and bulk elemental composition, surface condition, and oxide chemistry of interior and/or exterior surfaces. The key to good electropolishing and/or passivation is producing a highly Cr-enriched surface oxide, which imparts high corrosion resistance to the surface, while maintaining smooth and bright surfaces that will not shed particulates during use. The scientists at EAG Laboratories can help you navigate the SEMI, SEMASPEC, AMAT and other specifications governing the measurement of these properties for high-purity gas distribution systems.

Sample Preparation

Proper analysis of electropolished stainless steel begins with proper sample preparation. Incorrect tools can introduce external contaminants, while excessive heat from cutting can alter the nature of the passive oxide layer. EAG Laboratories has the know-how and capability to prepare and expose the analysis areas of electropolished stainless steel parts with negligible surface contamination and effect on the passive oxide layer, no matter the type of sample.

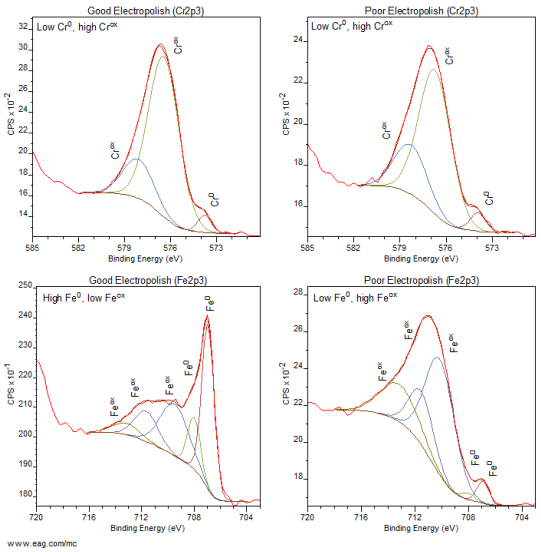
Bulk Chemistry

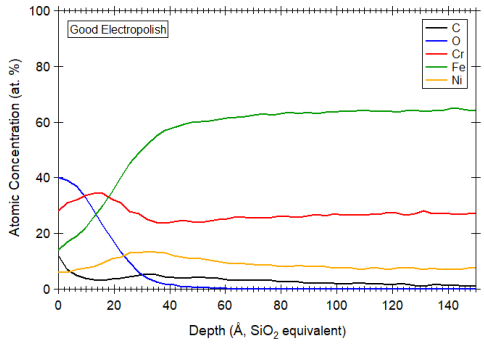
EAG Laboratories carries all the instrumentation necessary to measure elemental composition of stainless steel parts with sensitivity better than required for all specifications.

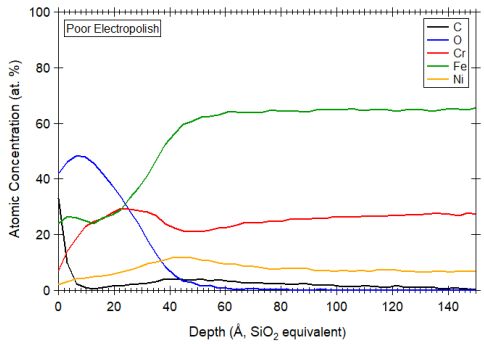
Near Surface Chemistry

Electropolishing of stainless steel produces a chromium-enriched surface which imparts enhanced corrosion resistance. However, the various chemicals used in the process can introduce contaminants to the surface. EAG Laboratories offers comprehensive testing to determine surface composition and chemistry in

compliance with many specifications. EAG can identify surface contamination by SEM/EDS and general near surface chemistry by AES and XPS/ESCA. We can determine the chromium enrichment using the $Cr^{metallic}/Fe^{metallic}$ and Cr^{ox}/Fe^{ox} ratios obtained by XPS. The passivation layer structure, encompassing the chromium-enriched oxide thickness, surface carbon layer thickness, detached iron oxide layer thickness, metal oxide layer thickness, and Cr/Fe ratios as a function of depth, is measured by AES.

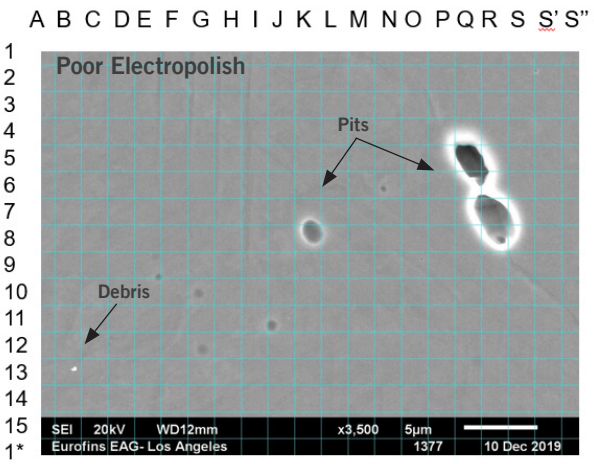


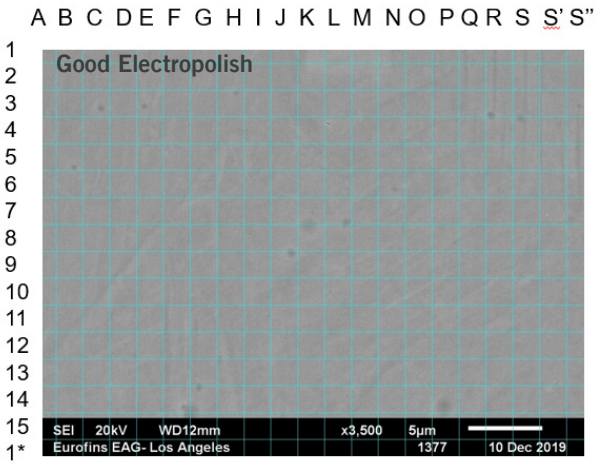




Surface Defects and Roughness

Electropolishing of metal surfaces also provides smooth, bright, and reflective surfaces through macro- and microsmoothing. The quality of the smoothing can be measured in the macroscopic scale by profilometry, while microscopic defects such as pits, inclusions, stringers, grooves, and other defects are evaluated using SEM at high magnification.





How We Can Help

Specifications supported

- AMAT 0250-13605 (XPS, AES, SEM, Profilometry)
- AMAT 0250-31083 (XPS, AES, SEM, Profilometry)
- ASME B46.1 (Profilometry)
- ASME BPE
- SEMASPEC 90120401B-STD (SEM)
- SEMASPEC 90120403B-STD (XPS)
- SEMASPEC 91060573B-STD (AES)
- SEMI F19 (XPS, AES, SEM, Profilometry, Elemental Analysis)
- SEMI F20 (Elemental Analysis)
- SEMI F37 (Profilometry)
- SEMI F60 (XPS)
- SEMI F72 (AES)
- SEMI F73 (SEM)

Our capabilities

- Sample preparation and cutting
- XPS/ESCA
- AES
- SEM/EDS
- Profilometry
- ICP-OES
- GDMS
- IGA