Globe United

Material Integrity, Made Visible

Metallographic examination for corrosion-resistant instrumentation in oil & gas service

GLOBE UNITED FZE

A certificate states intent. Metallography shows condition.

- In long-life sour, chloride-rich and elevated-temperature service, material integrity depends on the actual microstructure—not chemistry paperwork alone.
- Micro and macroexamination turn metallurgical condition into physical evidence for critical instrumentation and pressure-retaining components.

“What is the material really telling us?”

Source: Globe United FZE, “Micro and Macroexamination of Austenitic, Duplex and Nickel Alloys,” Introduction.

Macroexamination reveals the weld's full story.

01

GEOMETRY & FUSION

At low magnification, a prepared and etched section makes weld pass sequence, fusion line, HAZ, penetration and root fusion clearly visible.

02

DISCONTINUITY DETECTION

It provides a direct route to identifying critical flaws such as lack of fusion, lack of penetration, porosity clusters, cracks, undercut and misalignment.

03

OVERLAY INTEGRITY

For overlays and cladding in sour service, the macro section verifies bond integrity and confirms minimum overlay thickness across the examined area.

Source: Globe United FZE, "Micro and Macroexamination of Austenitic, Duplex and Nickel Alloys," Part 1.
Standards context: ASTM E340; ISO 17639; ASME BPVC Section IX, QW-183 / QW-184.

Microexamination answers the questions macro cannot.

- At approximately 50× to 1000×, the examination resolves grain structure, phase balance, precipitates, inclusions and micro-cracks.
- The heat-affected zone deserves particular attention because it is where service-relevant change can develop in welded corrosion-resistant alloys.

Disciplined Preparation

01 SECTIONING

02 MOUNTING

03 GRINDING

04 POLISHING

05 ETCHING

Reliable images start with a strictly controlled preparation sequence before any etchant is applied.

Source: Globe United FZE, "Micro and Macroexamination of Austenitic, Duplex and Nickel Alloys," Part 2. Standards context: ASTM E3, E407, E112, E562 / E1245.

For austenitics, sensitization is the central question.

The Metallurgical Risk

Chromium-carbide precipitation at grain boundaries can create chromium-depleted regions. These zones become highly susceptible to intergranular corrosion, particularly in sour and chloride-rich environments.

The ASTM A262 Screen

Practice A uses an electrolytic oxalic-acid etch to classify the structure as **step**, **dual**, or **ditch**.

A step structure is the desired screening result; dual and ditch structures require appropriate further disposition through hot-acid practices.

Critical message: A clean-looking alloy may still require microstructural confirmation.

Source: Globe United FZE, "Micro and Macroexamination of Austenitic, Duplex and Nickel Alloys," Part 3.

Duplex performance relies on a balanced structure.

- Duplex stainless steels derive their service properties from a carefully controlled austenite–ferrite balance.
- Excess ferrite, excess austenite, nitrides and intermetallic phases can severely compromise the intended corrosion resistance and toughness performance.
- ASTM A923 Method A serves as the metallographic screen for detrimental intermetallic phases; a flagged structure must be dispositioned through the standard's further mechanical or corrosion methods.

Best-Practice Reporting

FERRITE QUANTIFICATION

Beraha's contrast etch provides the crisp phase differentiation required for accurate ferrite point counting.

INTERMETALLIC SCREENING

Electrolytic NaOH etch specifically targets and reveals detrimental intermetallic phases for the ASTM A923 assessment.

Source: Globe United FZE, "Micro and Macroexamination of Austenitic, Duplex and Nickel Alloys," Part 4.

Nickel alloys demand equally deliberate preparation.

- The passive behaviour that suits nickel alloys to demanding service also makes their microstructure more challenging to reveal.
- Examination focuses on grain condition, cold work, secondary-phase precipitation, weld structure and dissimilar-metal dilution where relevant.
- Etching and interpretation must be selected to the specific alloy family and controlled through qualified laboratory practice.

KEY POINT

The more corrosion-resistant the alloy, the less acceptable a one-size-fits-all examination method becomes.

Source: Globe United FZE, "Micro and Macroexamination of Austenitic, Duplex and Nickel Alloys," Part 5.

The verification route follows the material risk.

ALLOY FAMILY	PRIMARY METALLURGICAL RISK	TYPICAL EVIDENCE ROUTE
Austenitic stainless	Sensitization / carbide network	ASTM A262 Practice A; microexamination
Duplex / super duplex	Phase imbalance and intermetallics	ASTM A923; ferrite quantification per ASTM E562 / E1245
Nickel-base alloy	Precipitates, cold work and weld condition	Alloy-appropriate microexamination; ASTM E407 / project requirements
All welded components	Fusion and geometry discontinuities	Macroexamination; ISO 17639 / ASME IX where applicable

Source: Globe United FZE, "Micro and Macroexamination of Austenitic, Duplex and Nickel Alloys," Part 7. Final acceptance criteria remain governed by the approved project specification, applicable standard and order documentation.

A credible report is designed for review.

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Microstructure is the contract.

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- Identify the specimen and orientation, preparation route, exact etchant conditions, standard and acceptance criteria.
- Include calibrated magnification and unambiguous classification against the relevant standard terminology.
- Pair macro images, micrographs and supporting measures such as hardness or ferrite assessment when the qualification package requires them.

Source: Globe United FZE, “Micro and Macroexamination of Austenitic, Duplex and Nickel Alloys,” Part 6.

Quality evidence should be integrated — not isolated.

- Globe United positions metallographic verification within a broader quality approach for austenitic, duplex and nickel-alloy instrumentation.
- The outcome is a clearer technical conversation around material selection, supplementary testing and documentation needs for critical projects.

Complementary Controls

- Positive Material Identification (PMI)
- Hardness Testing
- Ferrite Measurement
- Radiography
- EN 10204 3.1 / 3.2 Certification

Source: Globe United FZE, "Micro and Macroexamination of Austenitic, Duplex and Nickel Alloys," Conclusion.

Specify with confidence. Verify with evidence.

For sour, chloride and elevated-temperature service, discuss material selection, supplementary testing requirements and documentation packages with Globe United FZE.

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