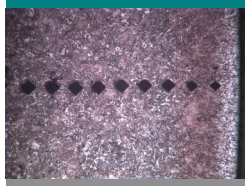
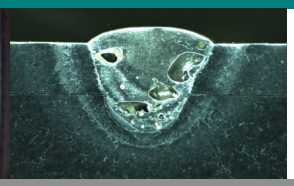
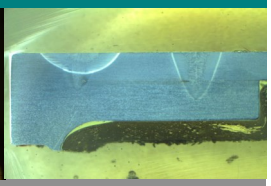


New Hampshire MATERIALS LABORATORY, INC.
Your Problem Solving Partner



ASTM A 262

Standard Practices for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

These practices cover the following five tests:

Practice A – Oxalic Acid Etch Test for Classification of Etch Structures of Austenitic Stainless Steels

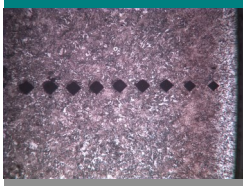
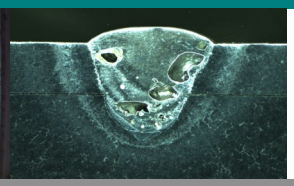
The oxalic acid etch test is used for acceptance of material but not for rejection of material. This may be used in connection with other evaluation tests to provide a rapid method for identifying those specimens that are certain to be free of susceptibility to rapid intergranular attack in these other tests. Such specimens have low corrosion rates in the various hot acid tests, requiring from 4 to 240 h of exposure. These specimens are identified by means of their etch structures, which are classified according to the following criteria:

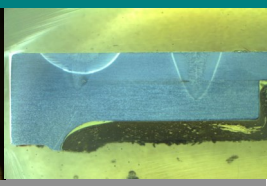
- The oxalic acid etch test may be used to screen specimens intended for testing in Practice B, C, E and F.
- Each practice contains a table showing which classifications of etch structures on a given stainless steel grade are equivalent to acceptable, or possibly nonacceptable performance in that particular test. Specimens having acceptable etch structures need not be subjected to the hot acid test. Specimens having nonacceptable etch structures must be tested in the specified hot acid solution.
- Extra-low-carbon grades, and stabilized grades, such as 304L, 316L, 317L, 321, and 347, are tested after sensitizing heat treatments at 650 to 675°C (1200 to 1250°F), which is the range of maximum carbide precipitation. These sensitizing treatments must be applied before the specimens are submitted to the oxalic acid etch test. The most commonly used sensitizing treatment in 1 h at 675°C (1250°F).

Practice B – Ferric Sulfate-Sulfuric Acid Test for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

This practice describes the procedure for conducting the boiling 120-h ferric sulfate-50% sulfuric acid test which measures the susceptibility of stainless steels to intergranular attack. The

New Hampshire Materials Laboratory, Inc
www.nhml.com • info@nhml.com
Tel: 800-334-5432 or 603-692-4110 • Fax: 603-692-4008



New Hampshire MATERIALS LABORATORY, INC.
Your Problem Solving Partner



ASTM A 262 Continued

presence or absence of intergranular attack in this test is not necessarily a measure of the performance of the material in other corrosive environments. The test does not provide a basis for predicting resistance to forms of corrosion other than intergranular, such as general corrosion, pitting, or stress-corrosion cracking.

The ferric sulfate-sulfuric acid test detects susceptibility to intergranular attack associated with the precipitation of chromium carbides in unstabilized austenitic stainless steels. It does not detect susceptibility to intergranular attack associated with sigma phase in wrought austenitic stainless steels containing molybdenum, such as Types 316, 316L, 317, and 317L. The ferric sulfate-sulfuric acid test will detect intergranular corrosion associated with sigma phase in the cast stainless steels CF-3M and CF-8M.

In stabilized stainless steel, Type 321 (and perhaps 347) and cast austenitic stainless steels containing molybdenum such as Types CF-8M, CF-3M, CG-8M, and CG-3M, the ferric sulfate-sulfuric acid test detects susceptibility associated with precipitated chromium carbides and with a sigma phase that may be invisible in the microstructure.

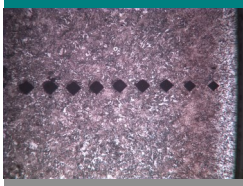
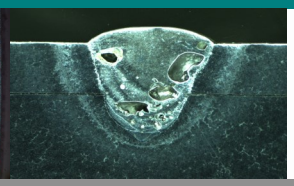
The ferric sulfate-sulfuric acid test may be used to evaluate the heat treatment accorded as-received material. It may also be used to check the effectiveness of stabilizing columbium or titanium additions and of reductions in carbon content in preventing susceptibility to rapid intergranular attack. It may be applied to wrought products (including tubes), casting, and weld metal.

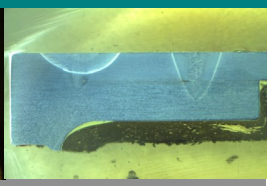
Specimens of extra low carbon and stabilized grades are tested after sensitizing heat treatments at 650 to 675°C (1200 to 1250°F), which is the range of maximum carbide precipitation. The length of time of heating used for this sensitizing treatment determines the maximum permissible corrosion rate for such grades in the ferric sulfate-sulfuric acid test. The most commonly used sensitizing treatment is 1 h at 675°C (1250°F).

Practice C – Nitric Acid Test for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

This practice describes the procedure for conducting the boiling nitric acid test as employed to measure the relative susceptibility of austenitic stainless steels to intergranular attack. The

New Hampshire Materials Laboratory, Inc
www.nhml.com • info@nhml.com
Tel: 800-334-5432 or 603-692-4110 • Fax: 603-692-4008



New Hampshire MATERIALS LABORATORY, INC.
Your Problem Solving Partner



ASTM A 262 Continued

presence or absence of intergranular attack in this test is not necessarily a measure of the performance of the material in other corrosive environments; in particular, it does not provide a basis for predicting resistance to forms of corrosion other than intergranular, such as general corrosion, pitting, or stress-corrosion cracking.

The boiling nitric acid test may be used to evaluate the heat treatment accorded “as-received” material. It is also sometimes used to check the effectiveness of stabilizing elements and of reductions in carbon content in preventing susceptibility to rapid intergranular attack.

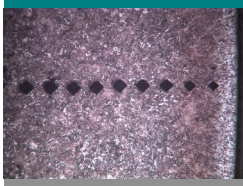
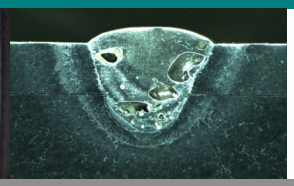
Specimens of extra-low -carbon and stabilized grades are tested after sensitizing heat treatments at 650 to 675°C (1200 to 1250°F), which is the range of maximum carbide precipitation. The length of time used for this sensitizing treatment determines the maximum permissible corrosion rate in the nitric acid test. The most commonly used sensitizing treatment is 1 h at 675°C (1250°F). This practice may be applied to wrought products (including tubes), castings, and weld metal of the various grades of stainless steel.

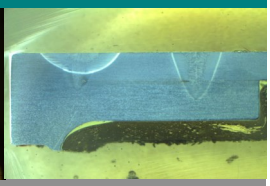
Practice E – Copper-Copper Sulfate-Sulfuric Acid Test for Detecting Susceptibility to Intergranular Attack in Austenitic Stainless Steels

This practice describes the procedure by which the copper-copper sulfate-16% sulfuric acid test is conducted to determine the susceptibility of austenitic stainless steels to intergranular attack. The presence or absence of intergranular corrosion in this test is not necessarily a measure of the performance of the material in other corrosive media. The test does not provide a basis for predicting resistance to other forms of corrosion, such as general corrosion, pitting, or stress-corrosion cracking.

The copper-copper sulfate-16% sulfuric acid test indicates susceptibility to intergranular attack associated with the precipitation of chromium-rich carbides. It does not detect susceptibility associated with sigma phase. This test may be used to evaluate the heat treatment accorded as-received material. It may also be used to evaluate the effectiveness of stabilizing element additions (Cb, Ti, and so forth) and reductions in carbon content to aid in resisting intergranular attack. All wrought products and weld material of austenitic stainless steels can be evaluated by this test.

New Hampshire Materials Laboratory, Inc
www.nhml.com • info@nhml.com
Tel: 800-334-5432 or 603-692-4110 • Fax: 603-692-4008



New Hampshire MATERIALS LABORATORY, INC.
Your Problem Solving Partner



ASTM A 262 Continued

Practice F – Copper-Copper Sulfate-50% Sulfuric Acid Test for Detecting Susceptibility to Intergranular Attack in Molybdenum-Bearing Cast Austenitic Stainless Steels

This practice describes the procedure for conducting the boiling copper-copper sulfate-50% sulfuric acid test, which measures the susceptibility of stainless steels to intergranular attack. The presence or absence of intergranular attack in this test is not necessarily a measure of the performance of the material in other corrosive environments. The test does not provide a basis for predicting resistance to forms of corrosion other than intergranular, such as general corrosion, pitting, or stress-corrosion cracking.

This test may be used to evaluate the susceptibility of as received material to intergranular corrosion caused by chromium carbide precipitation. It may also be used to evaluate the resistance of extra-low-carbon grades to sensitization to intergranular attack caused by welding or heat treatments.

This test should not be used to detect susceptibility to intergranular attack resulting from the formation of sigma phase. For detecting susceptibility to environments known to cause intergranular attack due to sigma, use Practice B or C.

If you have any questions concerning this particular ASTM method, please feel free to give our office a call at (800) 334-5432 or email us your inquiry at info@nhml.com.

(A262, A-262, A 262)

New Hampshire Materials Laboratory, Inc
www.nhml.com • info@nhml.com
Tel: 800-334-5432 or 603-692-4110 • Fax: 603-692-4008