



Standard Practice for Detecting mu-phase in Wrought Nickel-Rich, Chromium, Molybdenum-Bearing Alloys¹

This standard is issued under the fixed designation G209; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice incorporates etching and metallographic examination of Wrought Nickel-Rich, Chromium, Molybdenum-Bearing Alloys such as, but not limited to, UNS N06686 and UNS N10276.

1.2 Microstructures have a strong influence on properties and successful application of metals and alloys. The presence of mu-phase in the microstructure may significantly reduce the corrosion resistance of Wrought Nickel-Rich, Chromium, and Molybdenum-Bearing Alloys.

1.3 This practice may be used to determine the presence of mu-phase in Wrought Nickel-Rich, Chromium, and Molybdenum-Bearing Alloys through comparison of microstructure observed for etched metallographic specimens to a glossary of photomicrographs displaying the presence and absence of mu-phase in the microstructure.

1.4 The values stated in SI units are to be regarded as the standard. Other units are given in parentheses for information only.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D1193 Specification for Reagent Water

E3 Guide for Preparation of Metallographic Specimens

E7 Terminology Relating to Metallography

E1245 Practice for Determining the Inclusion or Second-

Phase Constituent Content of Metals by Automatic Image Analysis

E1268 Practice for Assessing the Degree of Banding or Orientation of Microstructures

G193 Terminology and Acronyms Relating to Corrosion

3. Terminology

3.1 *Definitions:*

3.1.1 The terminology used herein, if not specifically defined otherwise, shall be in accordance with Terminology **G193**. Definitions provided herein and not given in Terminology **G193** are limited only to this practice.

3.1.2 For metallographic definitions used in this practice, refer to Terminology **E7**.

3.1.3 For evaluation of inclusions, secondary phases and banding, if desired, refer to Practices **E1245** and **E1268**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *mu-phase* (μ), *n*—rhombohedral phase which may occur in Nickel-Rich, Chromium, Molybdenum-Bearing Alloys and may occur as coarse, irregular platelets, which form at high temperature.

4. Significance and Use

4.1 These test methods describe laboratory tests to determine the presence of mu-phase in Wrought Nickel-Rich, Chromium, and Molybdenum-Bearing Alloys through comparison of microstructure observed for etched metallographic specimens to a glossary of photomicrographs displaying the presence and absence of mu-phase in the microstructure. The presence of mu-phase in the microstructure may significantly reduce the corrosion resistance, strength, toughness and ductility of Wrought Nickel-Rich, Chromium, and Molybdenum-Bearing Alloys.

5. Sample Preparation and Etching³

5.1 *Sectioning:*

5.1.1 The selection of test specimens for metallographic examination is extremely important because, if their interpretation is to be of value, the specimens must be representative of

¹ This test method is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and is the direct responsibility of Subcommittee G01.05 on Laboratory Corrosion Tests.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Manning, Paul E., Ph.D., *Metallographic Preparation of 686 Etching Specimens*, Haynes International, Inc., Kokomo, IN, 2011.