



Standard Guide for Determining Synergism Between Wear and Corrosion¹

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1. Scope

1.1 This guide covers and provides a means for computing the increased wear loss rate attributed to synergism or interaction that may occur in a system when both wear and corrosion processes coexist. The guide applies to systems in liquid solutions or slurries and does not include processes in a gas/solid system.

1.2 This guide applies to metallic materials and can be used in a generic sense with a number of wear/corrosion tests. It is not restricted to use with approved ASTM test methods.

1.3 *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

G3 Practice for Conventions Applicable to Electrochemical Measurements in Corrosion Testing

G5 Reference Test Method for Making Potentiodynamic Anodic Polarization Measurements

G15 Terminology Relating to Corrosion and Corrosion Testing (Withdrawn 2010)³

G40 Terminology Relating to Wear and Erosion

G59 Test Method for Conducting Potentiodynamic Polarization Resistance Measurements

G102 Practice for Calculation of Corrosion Rates and Related Information from Electrochemical Measurements

¹ This guide is under the jurisdiction of ASTM Committee **G02** on Wear and Erosion and is the direct responsibility of Subcommittee **G02.40** on Non-Abrasive Wear.

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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 The last approved version of this historical standard is referenced on www.astm.org.

3. Terminology

3.1 *Definitions*—For general definitions relating to corrosion see Terminology **G15**. For definitions relating to wear see Terminology **G40**.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *cathodic protection current density, i_{cp}* —the electrical current density needed during the wear/corrosion experiment to maintain the specimen at a potential which is one volt cathodic to the open circuit potential.

3.2.2 *corrosion current density, i_{cor}* —the corrosion current density measured by electrochemical techniques, as described in Practice **G102**.

3.2.3 *electrochemical corrosion rate, C* —the electrochemical corrosion rate as determined by Practice **G59** and converted to a penetration rate in accordance with Practice **G102**. This penetration rate is equivalent to the volume loss rate per area. The term C_w is the electrochemical corrosion rate during the corrosive wear process, and the term C_o designates the electrochemical corrosion rate when no mechanical wear is allowed to take place.

3.2.4 *mechanical wear rate, W_o* —the rate of material loss from a specimen when the electrochemical corrosion rate has been eliminated by cathodic protection during the wear test.

3.2.5 *total material loss rate, T* —the rate of material loss from a specimen exposed to the specified conditions, including contributions from mechanical wear, corrosion, and interactions between these two.

3.2.6 *wear/corrosion interaction*—the change in material wastage resulting from the interaction between wear and corrosion, that is, T minus W_o and C_o . This can be sub-divided into ΔC_w , the change of the electrochemical corrosion rate due to wear and ΔW_c , the change in mechanical wear due to corrosion.

4. Summary of Guide

4.1 A wear test is carried out under the test conditions of interest and T is measured.

4.2 Additional experiments are conducted to isolate the mechanical and corrosion components of the corrosive wear process. These are as follows:

4.2.1 A repeat of the experiment in 4.1 with measurement of C_w ,