This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

Designation: D6442 – 06 (Reapproved 2020)

# Standard Test Method for Determination of Copper Release Rate From Antifouling Coatings in Substitute Ocean Water[1]

This standard is issued under the fixed designation D6442; 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 test method covers the laboratory determination of the rate at which copper is released from an antifouling (AF) coating in substitute ocean water. The practical limits for quantifying copper release rates by this method are from 1.8 to 500 µg $cm^{-2}d^{-1}$. This range may be extended to 0.2 to 500 µg $cm^{-2}d^{-1}$ if the analytical procedure described in Appendix X1 is followed.

NOTE 1—The term "substitute ocean water" is used throughout this standard to refer to artificial or synthetic seawater prepared in accordance with Practice D1141.

1.2 The procedure contains the preparation steps for the release rate determination of copper from antifouling paints including apparatus, reagents, holding tank conditions, and sampling point details. Analysis for the concentration of copper in substitute ocean water requires the accurate determination of copper at the low parts µg $L^{-1}$ (parts per billion, ppb) level. To detect and correct for reagent impurities, acceptable analytical precision standards are necessary. Therefore, the limit of quantitation (LOQ) for copper in substitute ocean water for the analytical method shall be 10 µg $L^{-1}$ (10 ppb) or less. The procedure for determining the LOQ for copper in substitute ocean water for the analytical method is found in Annex A2.

1.3 A suitable method is described in Appendix X1 (graphite furnace atomic absorption spectroscopy, GF-AAS). Other analytical methods may be utilized with relevant procedural changes, as needed, to accommodate selected specific methods. Such methods must meet the limit of quantitation for copper in substitute ocean water of 10 µg $L^{-1}$ (10 ppb) or less. See 1.2.

1.4 This results of this test method do not reflect environmental copper release rates for antifouling products, and are not suitable for direct use in the process of generating environmental risk assessments, environmental loading estimates, or for establishing release rate limits for regulatory purposes. See also Section 4 on Significance and Use.

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

1.6 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 7.

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers

D1141 Practice for the Preparation of Substitute Ocean Water

D1193 Specification for Reagent Water

## 3. Summary of Test Method

3.1 The candidate paint is applied to cylindrical test specimens. The coated specimens are placed in a tank of substitute ocean water where the copper levels are kept below 100 µg $L^{-1}$ by circulating the substitute ocean water through a suitable filtration system (see 5.3). At specified intervals, each specimen is placed in 1500 mL of substitute ocean water (see Section 9 for details) and rotated at 60 revolutions per minute (rpm) for 1 h (or less, see 9.8 for further explanation and instruction). The rate of copper release from the paint is determined by measuring copper concentrations of the substitute ocean water in the individual measuring containers.

3.2 Appendix X1 provides an analytical procedure for measuring copper concentrations in substitute ocean water.

[1] This test method is under the jurisdiction of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications and is the direct responsibility of Subcommittee D01.45 on Marine Coatings.

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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.

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