Designation: D4082 – 10

Standard Test Method for Effects of Gamma Radiation on Coatings for Use in Nuclear Power Plants[1]

This standard is issued under the fixed designation D4082; 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 a standard procedure for evaluating the lifetime radiation tolerance of coatings to be used in nuclear power plants. This test method is applicable to Coating Service Levels I, II, and III.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D659 Method for Evaluating Degree of Chalking of Exterior Paints (Withdrawn 1990)[3]

D660 Test Method for Evaluating Degree of Checking of Exterior Paints

D661 Test Method for Evaluating Degree of Cracking of Exterior Paints

D714 Test Method for Evaluating Degree of Blistering of Paints

D772 Test Method for Evaluating Degree of Flaking (Scaling) of Exterior Paints

D4538 Terminology Relating to Protective Coating and Lining Work for Power Generation Facilities

D5139 Specification for Sample Preparation for Qualification Testing of Coatings to be Used in Nuclear Power Plants

3. Terminology

3.1 *Definitions*—Definitions for use with this Test Method are shown in Terminology D4538 or other referenced standards.

4. Significance and Use

4.1 This test method is designed to provide a uniform test to assess the suitability of coatings, used in nuclear power facilities, under radiation exposure for the life of the facilities, including radiation during a DBA (Coating Service Level I areas only). Specific plant radiation exposure may exceed or be less than the amount specified in 7.2 of this standard. If required by the licensee design basis, the gamma dose used may exceed the actual anticipated plant gamma dose to account for beta dose. Coatings in Level II and III areas (outside primary containment) are expected to be exposed to lower accumulated radiation doses.

5. Preparation of Test Samples

5.1 *Steel Panels*—Panels shall be prepared in accordance with Specification D5139 or as approved by the licensee.

5.2 *Concrete Blocks*—Blocks shall be prepared in accordance with Specification D5139 or as approved by the licensee.

6. Sampling

6.1 Prepare and test specimens at least in duplicate, or as otherwise specified by the licensee.

7. Procedures

7.1 *Irradiation Dose Rate:*

7.1.1 Make the gamma energy field at the position of the test specimen 1×10^6 rads/h, or greater, unless otherwise specified by the licensee. It shall be uniform to within 10 % from one position of the specimen to another.

7.1.2 Make provisions so that all areas receive the same average exposure and dose, if the specimen is irradiated by a nonuniform source.

7.1.3 Determine the dose rate by a procedure acceptable to the coating manufacturer or as otherwise specified by the licensee.

7.2 *Irradiation Accumulated Dose*—Make the total irradiation accumulated dose 1×10^9 rads, unless otherwise specified by the licensee.

7.3 *Radiation Source*—A gamma radiation source capable of producing the dose rate and total accumulated dose specified in this standard, such as cobalt-60, unless otherwise specified by the licensee.

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[1] This test method is under the jurisdiction of ASTM Committee D33 on Protective Coating and Lining Work for Power Generation Facilities and is the direct responsibility of Subcommittee D33.02 on Service and Material Parameters.

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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.

7.4 *Test Environment:*

7.4.1 Specimens may be in air or in water during exposure to the gamma source, depending on the intended service as prescribed by the licensee.

7.4.2 Do not exceed a temperature of 140°F (60°C) for the specimen during irradiation, or as otherwise acceptable to the coating manufacturer or as specified by the licensee.

8. Testing Laboratory Report

8.1 The testing laboratory shall report the following information:

8.1.1 Unique test specimen identification and orientation of test specimen in test apparatus,

8.1.2 The type of radiation source and the test procedure and environment,

8.1.3 Both the initial dose rate and the total accumulated dose, and

8.1.4 Methodology for determining irradiation dose rate, irradiation accumulated dose, and specimen temperatures during test.

9. Examination

9.1 Examine and evaluate specimens immediately after irradiation for the following coating defects:

9.1.1 *Chalking* (Method D659)—Record extent.

9.1.2 *Checking* (Test Method D660)—Record extent.

9.1.3 *Cracking* (Test Method D661)—Record extent.

9.1.4 *Blistering* (Test Method D714)—Record number and extent.

9.1.5 *Flaking* (Test Method D772)—Record extent.

9.1.6 *Delamination*—Record extent.

9.1.7 Record any observation of unusual appearance or deterioration.

10. Acceptance Criteria

10.1 Acceptance criteria shall be defined by the licensee.

10.2 Unless otherwise specified, checking, cracking, flaking, delamination, and blistering are not permitted.

10.3 Any observations of unusual appearance, for example, chalking or color change, shall be reviewed against the plant design basis and evaluated for acceptability.

11. Documentation

11.1 Documentation shall include the following:

11.1.1 Procedures and conditions relating to the test specimen preparation

11.1.2 Testing Laboratory report.

11.1.3 Engineering assessment of the test results.

11.1.4 Photo documentation, or equivalent method, of the test panels in the before and after test condition.

12. Precision and Bias

12.1 The precision and bias of this test method is reflected in the precision and certified bias of the test instruments used.

13. Keywords

13.1 coatings; gamma radiation effects; irradiation accumulated dose; irradiation dose rate