



Standard Practice for Surveillance Testing of High-Temperature Nuclear Component Materials¹

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1. Scope

1.1 This practice covers procedures for specimen testing to establish changes occurring in the mechanical properties due to irradiation and thermal effects of nuclear component metallic materials where these materials are used for high temperature applications above 370°C (700°F).

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

2. Referenced Documents

2.1 ASTM Standards:²

[A370](#) Test Methods and Definitions for Mechanical Testing of Steel Products

[E3](#) Guide for Preparation of Metallographic Specimens

[E8/E8M](#) Test Methods for Tension Testing of Metallic Materials

[E21](#) Test Methods for Elevated Temperature Tension Tests of Metallic Materials

[E23](#) Test Methods for Notched Bar Impact Testing of Metallic Materials

[E29](#) Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

[E45](#) Test Methods for Determining the Inclusion Content of Steel

[E112](#) Test Methods for Determining Average Grain Size

[E139](#) Test Methods for Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials

[E185](#) Practice for Design of Surveillance Programs for Light-Water Moderated Nuclear Power Reactor Vessels

[E261](#) Practice for Determining Neutron Fluence, Fluence Rate, and Spectra by Radioactivation Techniques

[E453](#) Practice for Examination of Fuel Element Cladding Including the Determination of the Mechanical Properties

[E468](#) Practice for Presentation of Constant Amplitude Fatigue Test Results for Metallic Materials

[E482](#) Guide for Application of Neutron Transport Methods for Reactor Vessel Surveillance, E706 (IID)

[E606](#) Test Method for Strain-Controlled Fatigue Testing

[E647](#) Test Method for Measurement of Fatigue Crack Growth Rates

[E844](#) Guide for Sensor Set Design and Irradiation for Reactor Surveillance, E 706 (IIC)

[E1823](#) Terminology Relating to Fatigue and Fracture Testing

[E2006](#) Guide for Benchmark Testing of Light Water Reactor Calculations

[E2215](#) Practice for Evaluation of Surveillance Capsules from Light-Water Moderated Nuclear Power Reactor Vessels

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *test specimen*—a coupon or a piece of metal cut from a larger metal piece which is then machined to final size for testing to determine physical or mechanical properties.

4. Significance and Use

4.1 The requirements contained herein can be used as a basis for establishing conditions for safe operation of critical components. The requirements provide for general plant assessment and verification that materials meet design criteria. The test specimens and procedures presented in this practice are for guidance when establishing a surveillance program.

4.2 This practice for high-temperature materials surveillance programs is used when nuclear reactor component materials are monitored by specimen testing. Periodic testing is performed through the service life of the components to assess changes in selected material properties that are caused by neutron irradiation and thermal effects. The properties are those used as design criteria for the respective nuclear components. The extent of material property change caused by neutron irradiation depends on the composition and structure of the initial material, its conditioning in component fabrication, as well as the nature of the irradiation exposure. The need for

¹ This recommended practice is under the jurisdiction of ASTM Committee E10 on Nuclear Technology and Applications and is the direct responsibility of Subcommittee E10.02 on Behavior and Use of Nuclear Structural Materials.

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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.