Designation: C 1291 – 00a

Standard Test Method for Elevated Temperature Tensile Creep Strain, Creep Strain Rate, and Creep Time-to-Failure for Advanced Monolithic Ceramics[1]

This standard is issued under the fixed designation C 1291; 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 determination of tensile creep strain, creep strain rate, and creep time-to-failure for advanced monolithic ceramics at elevated temperatures, typically between 1073 and 2073 K. A variety of specimen geometries are included. The creep strain at a fixed temperature is evaluated from direct measurements of the gage length extension over the time of the test. The minimum creep strain rate, which may be invariant with time, is evaluated as a function of temperature and applied stress. Creep time-to-failure is also included in this test method.

1.2 This test method is for use with advanced ceramics that behave as macroscopically isotropic, homogeneous, continuous materials. While this test method is intended for use on monolithic ceramics, whisker- or particle-reinforced composite ceramics as well as low-volume-fraction discontinuous fiber-reinforced composite ceramics may also meet these macroscopic behavior assumptions. Continuous fiber-reinforced ceramic composites (CFCCs) do not behave as macroscopically isotropic, homogeneous, continuous materials, and application of this test method to these materials is not recommended.

1.3 The values in SI units are to be regarded as the standard (see Practice E 380).

1.4 *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:*

E 4 Practices for Force Verification of Testing Machines[2]

E 6 Terminology Relating to Methods of Mechanical Testing[2]

E 83 Practice for Verification and Classification of Extensometers[2]

E 139 Practice for Conducting Creep, Creep-Rupture, and Stress-Rupture Tests of Metallic Materials[2]

E 177 Practice for Use of the Terms Precision and Bias in ASTM Test Methods[3]

E 220 Test Method for Calibration of Thermocouples by Comparison Techniques[4]

E 230 Temperature-Electromotive Force (EMF) Tables for Standardized Thermocouples[4]

E 380 Practice for Use of the International System of Units (SI)[5]

E 639 Test Method for Measuring Total-Radiance Temperature of Heated Surfaces Using a Radiation Pyrometer[6]

E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method[3]

E 1012 Practice for Verification of Specimen Alignment Under Tensile Loading[2]

3. Terminology

3.1 *Definitions*—The definitions of terms relating to creep testing, which appear in Section E of Terminology E 6 shall apply to the terms used in this test method. For the purpose of this test method only, some of the more general terms are used with the restricted meanings given as follows.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *axial strain,* ϵ_a*, [nd], n*—the average of the strain measured on diametrically opposed sides and equally distant from the specimen axis.

3.2.2 *bending strain,* ϵ_b *[nd], n*—the difference between the strain at the surface and the axial strain.

3.2.2.1 *Discussion*—In general, it varies from point to point around and along the gage length of the specimen. **[E 1012]**

3.2.3 *creep-rupture test, n*— a test in which progressive specimen deformation and the time-to-failure are measured. In general, deformation is greater than that developed during a creep test.

3.2.4 *creep strain,* ϵ*, [nd], n*— the time dependent strain that occurs after the application of load which is thereafter maintained constant. Also known as engineering creep strain.

[1] This test method is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.01 on Properties and Performance.

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[2] *Annual Book of ASTM Standards,* Vol 03.01.

[3] *Annual Book of ASTM Standards,* Vol 14.02.

[4] *Annual Book of ASTM Standards,* Vol 14.03.

[5] Discontinued 1997; Replaced by IEEE/ASTM SI-10.

[6] *Annual Book of ASTM Standards,* Vol 15.03.

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