Advanced Ceramic Sentinel

An Information Summary for
ASTM Committee C28 on Advanced Ceramics

January 2023 – 37 years of High-Quality, Technically-Rigorous Normalization

Scope of Committee C28

The promotion of knowledge, stimulation of research and development of standards (classifications, specifications, nomenclature, test methods, guides, and practices) relating to processing, properties, characterization, and performance of advanced ceramic materials.

This committee works in concert with other technical committees (e.g., D30 "Composite Materials," C14 “Glass and Glass Products,” E07 "Non Destructive Testing," E08 "Fatigue and Fracture," E28 "Mechanical Testing," F04 "Medical and Surgical Materials and Devices", and G02 "Wear and Erosion") and other national and international organizations having mutual or related interests.

What Committee C28 Does

Committee C28 develops and maintains standards for monolithic and composite advanced ceramics. An advanced ceramic is a highly-engineered, high-performance predominately non-metallic, inorganic, ceramic material having specific functional attributes. The C28 standards cover methods for testing bulk and constituent (powders, fibres, etc.) properties, thermal and physical properties, strengths and strength distributions, and performance under varying environmental, thermal, and mechanical conditions. The scope of application of the methods ranges from quality control through design data generation.

The Committee's primary objective is the development of technically rigorous standards which are accessible to the general industrial laboratory and consequently are widely accepted and used in the design, production, and utilization of advanced ceramics.

While the committee's roots are in energy-related industries and programs, C28 supports the needs of automotive, aerospace, electronic, medical and other industries requiring advanced ceramics. Some specific applications include nano-ceramics, bio-ceramics, coatings, electronics, sensors/actuators, porous substrates and fuel cells. C28 actively pursues standards development to support these emerging applications.

Committee C28 coordinates its work with other organizations with mutual interests in advanced ceramics. The membership represents an international group of people interested in furthering advanced ceramic technology.

In addition to standards development, C28 sponsors symposia providing a forum for the timely transfer of technical information relevant to the design, analysis, processing, fabrication, and characterization of monolithic and composite advanced ceramics. Special workshops and technical presentations are often held to identify specific industrial needs and support the technical development of new standards.

The Committee meets twice a year in with an on-site meeting and a Web-teleconference. The Committee is self-regulated by committee-approved by-laws under the auspices of ASTM International.

COMMITTEE C28 - ADVANCED CERAMICS
2020-22 Officers and Committee Structure

Chair: Michael Jenkins, Bothell Eng & Science Technologies
Vice Chair: Stephen Gonczy, Gateway Materials Technology
Recording Secretary: Jamie Westbrook, Corning R & D Corporation
Membership Secretary: Randall Stafford, Retired-Consultant

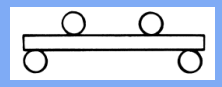
C28.90 Executive	C28.91 Editorial and Nomenclature	C28.92 Education / Outreach	C28.93 Awards	C28.95 Long Range Planning

C28.01 Mechanical Properties and Reliability	C28.03 Physical Properties and NDE	C28.04 Ceramic Applications	C28.07 Ceramic Matrix Composites

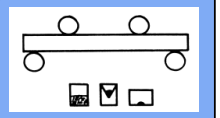
Committee C28 Advanced Ceramic Standards

Visit the C28 website (http://www.astm.org/COMMITTEE/C28.htm) to purchase C28 standards or to join Committee C28.

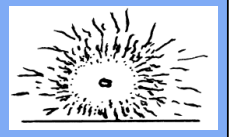
Monolithics



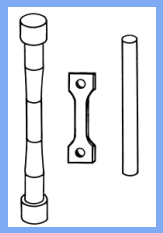
C 1161 Flexural Strength (RT)
C 1211 Flexural Strength (HT)
C 1368 Slow Crack Growth (RT, Dyn Fatigue)
C 1465 Slow Crack Growth (HT, Dyn Fatigue)
C 1576 Slow Crack Growth (RT, Stress Rupture)
C 1684 Flexural Strength (Rods)
C 1834 Slow Crack Growth (HT, Stress Rupture)

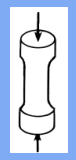


C 1421 RT Fracture Toughness



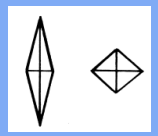
C 1322 Fractography
C 1678 Fracture Mirror





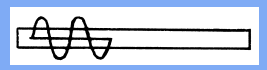
C 1424 Compression Strength (RT)

C 1273 Tensile Strength (RT)
C 1291 Creep, Creep Rupture
C 1366 Tensile Strength (HT)
C 1361 Cyclic Fatigue

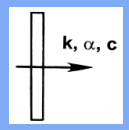


C 1326 Knoop Hardness
C 1327 Vickers Hardness

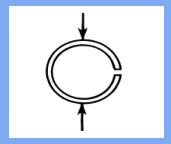
C 1499 Biaxial Strength (RT)



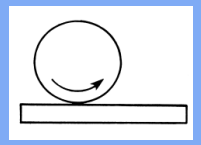
C 1198 Elastic Modulus - continuous
C 1259 Elastic Modulus - impulse



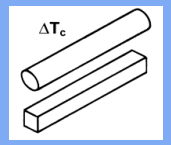
C 1470 Thermal Guide



C 1323 C-ring Strength



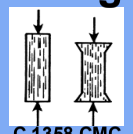
C 1495 Grinding



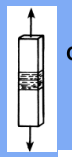
C 1525 Thermal Shock

Composites, Coatings, Porous Ceramics

C 1275 CMC Tensile Strength (RT)
C 1337 CMC Creep, Creep Rupture
C 1359 CMC Tensile Strength (HT)
C 1360 CMC Cyclic Fatigue
C 1773 CMC Tube Axial Tensile (RT)
C 1869 CMC Open Hole Tensile (RT)



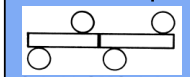
C 1358 CMC Compression Strength



C 1468 CMC Tensile Strength Trans Thickness

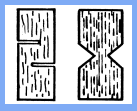
C 1862 End Plug Adhesion

C 1819 and C1863 Hoop Tensile Strength of CMC Tubes

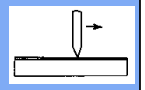


C 1469 CMC Joint Strength

C 1341 CMC Flexure Strength
C 1674 Honeycomb Flex Strength
C 1899 CMC Tube Flex Strength



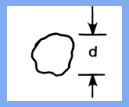
C 1557 Filament Strength & Stiffness



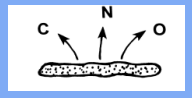
C 1783 Guide for Specs C-C Composites
C 1793 Guide for Specs SiC-SiC CMCs
C 1835 Classification for SiC-SiC CMC
C 1836 Classification for C-C Composites

C 1292 CMC Shear Strength (RT)
C 1425 CMC Shear Strength (HT)
C 1624 Coatings – Scratch Adhesion

Powders



C 1070 Particle Size, Laser Light
C 1274 Particle Size, BET
C 1282 Particle Size, Centrifugal Sed
C 1730 Particle Size Distribution, X-Ray Gravity Sedimentation

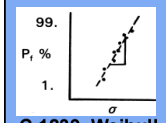


C 1494 C, N, O in silicon nitride

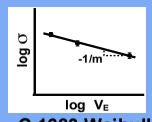
Subcommittees

C28.01 Mech. Prop. + Reliability
C28.03 Physical Prop. + NDE
C28.04 Applications
C28.07 Ceramic Matrix Composites
C28.91 Terminology

NDE and Design



C 1239 Weibull

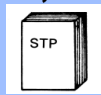


C 1683 Weibull Scaling

C 1212 Seeded Voids
C 1336 Seeded Inclusions

C 1175 NDE Guide

Terms, Workshops, Education



STP 1201 Life Prediction
STP 1309 Composites
STP 1392 Composites
STP 1409 Fracture

C 1145 Terminology

ASTM C28 standards are found in Vol. 15.01 of the Annual Book of ASTM Standards

01-2023

Graphical illustration of standards under the jurisdiction of Committee C28
(Note: CXXXX refers to a specific standard, STPXXXX refers to Standard Technical Publication)

Subcommittee Details

C28.01 Mechanical Properties & Reliability

C28.01 Interim Chair: Michael Jenkins
Bothell Eng & Science Technologies, Bothell, WA
e-mail: jenkinsm@csufresno.edu

C28.01 Scope:

Develops standards for mechanical properties and reliability (short term and long term) of monolithic advanced ceramics in a number of areas including flexural strength, tensile strength, compressive strength, cyclic fatigue, creep and creep rupture, hardness, and fracture toughness.

C28.01 Standards:

C1161-18 (90) Test Method for Flexural Strength of Advanced Ceramics at Ambient Temperature

C1198-20 (91) Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio for Advanced Ceramics by Sonic Resonance

C1211-18 (92) Test Method for Flexural Strength of Advanced Ceramics at Elevated Temperature

C1239-13 (93) [Reapproved 2018] Practice for Reporting Uniaxial Strength Data and Estimating Weibull Distribution Parameters for Advanced Ceramics

C1259-21 (94) Test Method for Dynamic Young's Modulus, Shear Modulus, and Poisson's Ratio for Advanced Ceramics by Impulse Excitation of Vibration

C1273-18 (94) Test Method for Tensile Strength of Monolithic Advanced Ceramics at Ambient Temperatures

C1291-18 (95) Test Method for Elevated Temperature Tensile Creep Strain, Creep Strain Rate, and Creep Time-to-Failure for Advanced Monolithic Ceramics

C1322-15 (96) [Reapproved 2019] Practice for Fractography and Characterization of Fracture Origins in Advanced Ceramics

C1326-13 (96) [Reapproved 2018] Test Method for Knoop Indentation Hardness of Advanced Ceramics

C1327-15 (96) [Reapproved 2019] Test Method for Vickers Indentation Hardness of Advanced Ceramics

C1361-10 (96) [Reapproved 2019] Practice for Constant-Amplitude, Axial, Tension-Tension Cyclic Fatigue of Advanced Ceramics at Ambient Temperatures

C1366-19 (97) Test Method for Tensile Strength of Monolithic Advanced Ceramics at Elevated Temperatures

C1368-18 (97) Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Flexural Testing at Ambient Temperature

C1421-18 (99) Test Methods for the Determination of Fracture Toughness of Advanced Ceramics

C1424-15 (99) Test Method for Compressive Strength of Monolithic Advanced Ceramics at Ambient Temperatures

C1465-08 (00) [Reapproved 2019] Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress-Rate Flexural Testing at Elevated Temperature

C1495-16 (01) Test Method for Effect of Surface Grinding on Flexure Strength of Advanced Ceramics

C1499-19 (02) Test Method for Monotonic Equibiaxial Flexural Strength Testing of Advanced Ceramics at Ambient Temperature

C1525-18 (02) Test Method for Determination of Thermal Shock Resistance for Advanced Ceramics by Water Quenching

C1576-05 (05) [Reapproved 2017] Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress Flexural Testing (Stress Rupture) at Ambient Temperature

C1683-10 (08) [Reapproved 2019] Practice for Size Scaling of Tensile Strengths Using Weibull Statistics for Advanced Ceramics

C1684-18 (08) Test Method for Flexural Strength of Advanced Ceramics at Ambient Temperature -Cylindrical Rods

C1834-16 (16) Test Method for Determination of Slow Crack Growth Parameters of Advanced Ceramics by Constant Stress Flexural Testing (Stress Rupture) at Elevated Temperatures

C1862-17 (17) Test Method for the Nominal Joint Strength of End-Plug Joints in Advanced Ceramic Tubes at Ambient and Elevated Temperatures

PS070-97 Withdrawn in 1999 – Replaced by C1421 Test Methods for the Determination of Fracture Toughness of Advanced Ceramics

C28.03 Physical Properties & NDE

C28.03 Chair: Tony Thornton
Micromeritics, Norcross, GA
e-mail: tony.thornton@micromeritics.com

C28.03 Scope:

Develops standards for physical, chemical, micro-structural, and non-destructive characterization of powder and bulk advanced ceramics.

C28.03 Standards:

C1070-01 (01) [Reapproved 2020] Test Method for Determining Particle Size Distribution of Alumina or Quartz by Laser Light Scattering

C1175-10 (91) Withdrawn in 2018 Guide to Test Methods for Nondestructive Testing of Advanced Ceramics

C1212-15 (92) Withdrawn in 2018 Practice for Fabricating Ceramic Reference Specimens Containing Seeded Voids

C1251-95 Withdrawn in 2000 Guide for Determination of Specific Surface Area of Advanced Ceramic Materials by Gas Adsorption

C1274-12 (94) [Reapproved 2020] Test Method for Advanced Ceramic Specific Surface Area by Physical Adsorption

C1282-12 (95) Withdrawn in 2014 Test Method for Determining the Particle Size Distribution of Advanced Ceramics by Centrifugal Photosedimentation

C1331-12 (96) Jurisdiction changed to E07 Nondestructive Testing in 2015 Practice for Measuring Ultrasonic Velocity in Advanced Ceramics with the Broadband Pulse-Echo Cross-Correlation Method

C1332-13 (96) Jurisdiction changed to E07 Nondestructive Testing in 2015 Test Method for Measurement of Ultrasonic Attenuation Coefficients of Advanced Ceramics by the Pulse-Echo Contact Technique

C1336-14 (96) Withdrawn in 2018 Practice for Fabricating Non-Oxide Ceramic Reference Specimens Containing Seeded Inclusions

C1470-20 (00) Guide for Testing the Thermal Properties of Advanced Ceramics

C1494-13 (01) [Reapproved 2018] Test Method for Determination of Mass Fraction of Carbon, Nitrogen, and Oxygen in Silicon Nitride Powder

C1678-21 (10) [Reapproved 2015] Practice for Fractographic Analysis of Fracture Mirror Sizes in Ceramics and Glasses

C1730-17 (17) [Reapproved 2022] Test Method for Particle Size Distribution of Advanced Ceramics by X-Ray Monitoring of Gravity Sedimentation

C28.04 Applications

C28.04 Chair: Randy Stafford
Retired-Consultant, Columbus, IN
e-mail: rjsrunning3500@yahoo.com

C28.04 Scope:

Develops standards (including guides, specifications, practices, test methods) for various engineering applications of advanced ceramics, such as nanoceramics, coatings, electrodes, porous ceramics, fuel cells, armor, sensors/actuators, thermal systems.

C28.04 Standards:

C1323-22 (96) Test Method for Ultimate Strength of Advanced Ceramics with Diametrally Compressed C-Ring Specimens at Ambient Temperature

C1624-22 (05) Test Method for Adhesion Strength and Mechanical Failure Modes of Ceramic Coatings by Quantitative Single Point Scratch Testing

C1674-16 (11) Test Method for Flexural Strength of Advanced Ceramics with Engineered Porosity (Honeycomb Cellular Channels) at Ambient Temperatures

*-XX indicates year of current version, (XX) indicates year of original approval and publication if different than –XX

C28.07 Ceramic Matrix Composites

C28.07 Chair: Andrew Wereszczak

Oak Ridge National Laboratory, Oak Ridge, TN
Material Properties and Mechanics Group
e-mail: wereszczakaa@ornl.gov

C28.07 Scope:

Develops standards for determination of the thermo-mechanical properties and performance of ceramic matrix composites including tension, compression, shear, flexure, cyclic fatigue, creep/creep rupture, ceramic fibers, interfacial properties, thermo-mechanical fatigue, environmental effects, and structural/component testing.

C28.07 Standards:

C1275-18 (94) Test Method for Monotonic Tensile Behavior of Continuous Fiber-Reinforced Advanced Ceramics with Solid Rectangular Cross-Section at Ambient Temperatures

C1292-22 (95) Test Method for Shear Strength of Continuous Fiber-Reinforced Advanced Ceramics at Ambient Temperatures

C1337-17 (96) Test Method for Creep and Creep Rupture of Continuous Fiber-Reinforced Ceramic Composites under Tensile Loading at Elevated Temperature

C1341-13 (96) [Reapproved 2018] Test Method for Flexural Properties of Continuous Fiber-Reinforced Advanced Ceramic Composites

C1358-18 (96) Test Method for Monotonic Compressive Strength Testing of Continuous Fiber-Reinforced Advanced Ceramics with Solid Rectangular Cross-Section Specimens at Ambient Temperatures

C1359-18^{e1}(96) Test Method for Monotonic Tensile Strength Testing of Continuous Fiber-Reinforced Advanced Ceramics with Solid Rectangular Cross-Section Specimens at Elevated Temperatures

C1360-17 (96) Practice for Constant-Amplitude, Axial, Tension-Tension Cyclic Fatigue of Continuous Fiber-Reinforced Advanced Ceramics at Ambient Temperatures

C1425-19 (99) Test Method for Interlaminar Shear Strength of 1-D and 2-D CFCCs at Elevated Temperatures

C1468-19^{a} (00) Test Method for Transthickness Tensile Strength of Continuous Fiber-Reinforced Advanced Ceramics at Ambient Temperatures

C1469-22 (00) Test Method for Shear Strength of Joints of Advanced Ceramics at Ambient Temperature

C1557-20 (03) Test Method for Tensile Strength and Young's Modulus of Fibers

C1773-21 (13) Test Method for Monotonic Axial Tensile Behavior of Continuous Fiber-Reinforced Advanced Ceramic Tubular Test Specimens at Ambient Temperature

C1783-15 (15) Guide for Development of Specifications for Fiber Reinforced Silicon Carbide-Silicon Carbide Composite Structures for Nuclear Applications

C1793-15 (15) Guide for Development of Specifications for Fiber Reinforced Carbon-Carbon Composite Structures for Nuclear Applications

C1819-21 (15) Test Method for Hoop Tensile Strength of Continuous Fiber-Reinforced Advanced Ceramic Composite Tubular Test Specimens at Ambient Temperature Using Elastomeric Inserts

C1835-16 (16) Classification for Fiber Reinforced Silicon Carbide-Silicon Carbide (SiC-SiC) Composite Structures

C1836-16 (16) Classification for Fiber Reinforced Carbon-Carbon Composite Structures

C1863-18 (18) Test Method for Hoop Tensile Strength of Continuous Fiber-Reinforced Advanced Ceramic Composite Tubular Test Specimens at Ambient Temperature Using Direct Pressurization

C1869-18 (18) Test Method for Open-Hole Tensile Strength of Fiber-Reinforced Advanced Ceramic Composites

C1899-21 (21) Test Method Test Method for Flexural Strength of Continuous Fiber-Reinforced Advanced Ceramic Tubular Test Specimens at Ambient Temperature

D3379-75 (89) Withdrawn in 1998 Test Method for Tensile Strength and Young's Modulus for High-Modulus Single-Filament Materials

C28.90 Executive Subcommittee

C28.90 Chair: Michael Jenkins

Bothell Eng & Science Technologies, Bothell, WA
e-mail: jenkinsm@csufresno.edu

C28.90 Scope:

Manages administrative matters of main committee C28 through its membership comprised of the committee and subcommittee officers of C28.

C28.91 Nomenclature and Editorial

C28.91 Chair: Jonathan Salem

NASA-Glenn Research Center, Cleveland, OH
e-mail: Jonathan.A.Salem@grc.nasa.gov

C28.91 Scope:

Compiles nomenclature and terminology used in the various standards of C28.

C28.91 Standards:

C1145-19 (91) Terminology on Advanced Ceramics

C1286-94 Withdrawn in 2002 Classification for Advanced Ceramics

C28.92 Education and Outreach

C28.92 Chair: Jonathan Salem

NASA-Glenn Research Center, Cleveland, OH
e-mail: Jonathan.A.Salem@grc.nasa.gov

C28.92 Scope:

Develops and supports efforts for education and outreach for the C28 committee.

C28.92 Documents:

Advanced Ceramic Sentinel

C28.93 Awards

C28.93 Chair: Jonathan Salem

NASA-Glenn Research Center, Cleveland, OH
e-mail: Jonathan.A.Salem@grc.nasa.gov

C28.93 Scope:

Accepts/acts on nominations for various awards

C28.95 Long Range Planning

C28.95 Chair: Stephen Gonczy

Gateway Materials Technology, Mount Prospect, IL
e-mail: gatewaymt@aol.com

C28.95 Scope:

Proposes, facilitates and promotes long range planning activities consistent with the mission, goals and objectives of the Committee and its subcommittees.

Documents:

Committee C28 Strategic Plan

Symposia Publications

STP 1201	Life Prediction Methodologies and Data for Ceramic Materials
STP 1309	Thermal and Mechanical Test Methods and Behavior of Continuous-Fiber Ceramic Composites
STP 1392	Mechanical, Thermal and Environmental Testing and Performance of Ceramic Composites and Components
STP 1409	Fracture Resistance Testing of Monolithic and Composite Brittle Materials

Future C28 Meetings

2023 – Sunday, 21 January
In conjunction w/ ACerS 47th ICACC, Daytona Beach, FL

2023 – Wednesday, 19 or 26 July
WebX/Teleconference; Contact Staff Manager for details

Main Committee Officers (2020 and 2021)

Chair
Michael G. Jenkins
Bothell Engineering & Science Technologies, Inc.
17815-93rd Pl NE
Bothell, WA 98011 U.S.A.
Tel: 425-876-7061, FAX: N/A
e-mail: jenkinsm@csufresno.edu

Vice Chair
Stephen T. Gonczy
Gateway Materials Technology
221 S Emerson
Mount Prospect, IL 60056 U.S.A.
Tel: 847-870-1621, FAX: 847-870-1624
e-mail: gatewaymt@aol.com

Recording Secretary
Jamie Westbrook
Corning Research and Development Corporation
SP-FR-04
Corning, NY 14831 U.S.A.
Tel: 607-974-2425, FAX: 607-438-0678
e-mail: westbroojt@corning.com

Membership Secretary
Randy Stafford
Retired-Consultant
4055 Sandpiper Lane
Columbus, IN 47023 U.S.A.
Tel: 812-344-2919, FAX: 812-377-7226
e-mail: rjsrunning3500@yahoo.com

Members at Large

Leon Chuck
Pressbox Photo LLC
228 Triangle Avenue
Oakwood, OH 45419 U.S.A.
Tel: 937-304-8478; FAX:
e-mail: leon.chuck@sbcglobal.net

Stephen F. Duffy
Cleveland State University
2997 Sussex Court
Stow, OH, 44135 U.S.A.
Tel: 330-388-0511, FAX: 918-513-6950
e-mail: duffy@crtechnologies.com

Joseph Homeny
Edw Orton Jr Ceramic Foundation
6991 Old 3C Highway
Westerville, Oh 43082 U.S.A.
Tel: 614-818-1323; FAX: 614-895-5610
e-mail: Homeny@Ortonceramic.com

Jonathan A. Salem
NASA Glenn Research Center
21000 Brookpark Road / MS 49-7
Cleveland, OH 44135 U.S.A.
Tel: 440-724-5070, FAX: 216-977-7051
e-mail: jonathan.a.salem@nasa.gov

ASTM Administration

C28 Staff Manager -- James Farrell
ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959 U.S.A.
Tel: (610) 832-9661, FAX: (610) 832-9666
e-mail: jfarrell@astm.org

Administrative Assistant – Elizabeth Lees
ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959 U.S.A.
Tel: 610-832-9692, FAX: 610-832-9666
e-mail: elees@astm.org

Editor --
ASTM International - Christine Leinweber
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959 U.S.A.
Tel: 610-832-9705, FAX: 610-832-9666
e-mail: cleinweber@astm.org