



Standard Practice for Size Scaling of Tensile Strengths Using Weibull Statistics for Advanced Ceramics¹

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1. Scope

1.1 This standard practice provides methodology to convert fracture strength parameters (primarily the mean strength and the Weibull characteristic strength) estimated from data obtained with one test geometry to strength parameters representing other test geometries. This practice addresses uniaxial strength data as well as some biaxial strength data. It may also be used for more complex geometries proved that the effective areas and effective volumes can be estimated. It is for the evaluation of Weibull probability distribution parameters for advanced ceramics that fail in a brittle fashion. Fig. 1 shows the typical variation of strength with size. The larger the specimen or component, the weaker it is likely to be.

1.2 As noted in Practice C1239, the failure strength of advanced ceramics is treated as a continuous random variable. A number of functions may be used to characterize the strength distribution of brittle ceramics, but the Weibull distribution is the most appropriate especially since it permits strength scaling for the size of specimens or component. Typically, a number of test specimens with well-defined geometry are broken under well-defined loading conditions. The force at which each test specimen fails is recorded and fracture strength calculated. The strength values are used to obtain Weibull parameter estimates associated with the underlying population distribution.

1.3 This standard is restricted to the assumption that the distribution underlying the failure strengths is the two-parameter Weibull distribution with size scaling. The practice also assumes that the flaw population is stable with time and that no slow crack growth occurs.

1.4 This practice includes the following topics:

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1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5.1 The values stated in SI units are in accordance with IEEE/ASTM SI 10.

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 and health practices and determine the applicability of regulatory limitations prior to use.*

¹ This practice is under the jurisdiction of ASTM Committee C28 on Advanced Ceramics and is the direct responsibility of Subcommittee C28.01 on Mechanical Properties and Performance.

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