



Standard Test Method for Determining Threshold Stress Intensity Factor for Environment-Assisted Cracking of Metallic Materials¹

This standard is issued under the fixed designation E 1681; 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 the environment-assisted cracking threshold stress intensity factor parameters, K_{IEAC} and K_{EAC} , for metallic materials from constant-force testing of fatigue precracked beam or compact fracture specimens and from constant-displacement testing of fatigue precracked bolt-load compact fracture specimens.

1.2 This test method is applicable to environment-assisted cracking in aqueous or other aggressive environments.

1.3 Materials that can be tested by this test method are not limited by thickness or by strength as long as specimens are of sufficient thickness and planar size to meet the size requirements of this test method.

1.4 A range of specimen sizes with proportional planar dimensions is provided, but size may be variable and adjusted for yield strength and applied force. Specimen thickness is a variable independent of planar size.

1.5 Specimen configurations other than those contained in this test method may be used, provided that well-established stress intensity calibrations are available and that specimen dimensions are of sufficient size to meet the size requirements of this test method during testing.

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.*

2. Referenced Documents

2.1 ASTM Standards:

D 1141 Specification for Substitute Ocean Water²

E 8 Methods for Tension Testing of Metallic Materials³

E 399 Test Method for Plane-Strain Fracture Toughness of Metallic Materials³

E 647 Test Method for Measurement of Fatigue Crack Growth Rates³

¹ This test method is under the jurisdiction of ASTM Committee E08 on Fatigue and Fracture and is the direct responsibility of Subcommittee E08.06 on Crack Growth Behavior.

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² Annual Book of ASTM Standards, Vol 11.02.

³ Annual Book of ASTM Standards, Vol 03.01.

E 1823 Terminology Relating to Fatigue and Fracture Testing³

G 1 Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens⁴

G 5 Standard Reference Method for Making Potentiostatic and Potentiodynamic Anodic Polarization Measurements⁴

G 15 Terminology Relating to Corrosion and Corrosion Testing⁴

3. Terminology

3.1 Definitions:

3.1.1 For definitions of terms relating to fracture testing used in this test method, refer to Terminology E 1823.

3.1.2 For definitions of terms relating to corrosion testing used in this test method, refer to Terminology G 15.

3.1.3 *stress-corrosion cracking (SCC)*—a cracking process that requires the simultaneous action of a corrosive and sustained tensile stress.

3.1.4 *stress intensity factor threshold for plane strain environment-assisted cracking ($K_{IEAC}[FL^{-3/2}]$)*—the highest value of the stress intensity factor (K) at which crack growth is not observed for a specified combination of material and environment and where the specimen size is sufficient to meet requirements for plane strain as described in Test Method E 399.

3.1.5 *stress intensity factor threshold for environment-assisted cracking ($K_{EAC}[FL^{-3/2}]$)*—the highest value of the stress intensity factor (K) at which crack growth is not observed for a specified combination of material and environment and where the measured value may depend on specimen thickness.

3.1.6 *physical crack size ($a_p[L]$)*—the distance from a reference plane to the observed crack front. This distance may represent an average of several measurements along the crack front. The reference plane depends on the specimen form, and it is normally taken to be either the boundary or a plane containing either the loadline or the centerline of a specimen or plate. The reference plane is defined prior to specimen deformation.

3.1.7 *original crack size ($a_o[L]$)*—the physical crack size at the start of testing.

⁴ Annual Book of ASTM Standards, Vol 03.02.