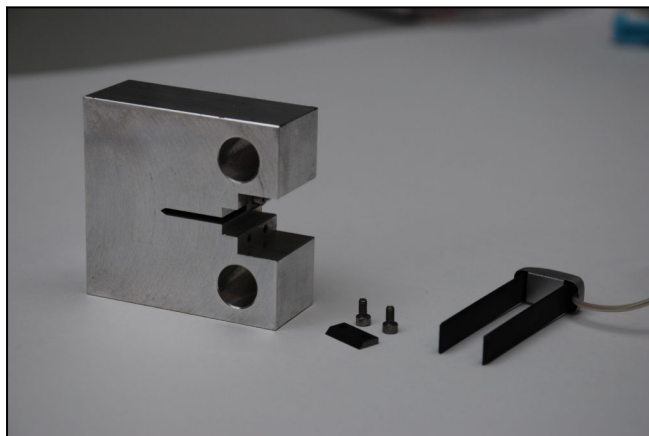


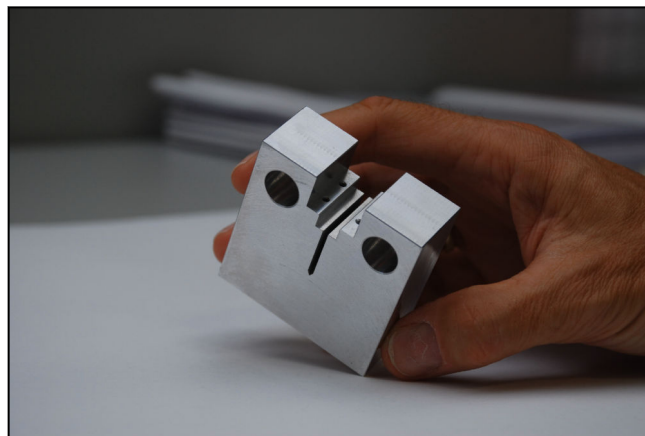
Product Information

testXpert R Fracture Mechanics Testing Software for Determination of the Fracture Toughness for J1C and CTOD acc. to ASTM E1820

CTA: 300035 300036



Specimen with bolt-on knife edges and crack-opening displacement extensometer



Specimen with offset notch

testXpert Research fracture mechanics testing software is used for the determination of the fracture toughness for J1C and the crack tip opening displacement CTOD (δ) according to ASTM E1820 – 2020b using the single-specimen method (resistance curve procedure). It is suitable for C(T), DC(T) and SE(B) specimens.

Depending on the material behavior, different approaches are used in fracture mechanics. Elastic-plastic fracture mechanics describes the failure of ductile materials. Crack-tip parameters J and δ characterize elastic-plastic loading. When critical values are reached, they result in crack initiation and stable crack growth.

The test consists of three basic parts:

1. In the first part, the specimen is prepared by generating the fatigue crack. This is referred to as pre-cracking.
2. The second part is the actual test, in which primarily force and displacement or strain values are recorded,

allowing provisional fracture-toughness values of the material to be determined.

3. During the third part, the values obtained in the test are studied and corrected or refined through subsequent evaluation until eventually a definitive fracture-toughness value is determined for the material.

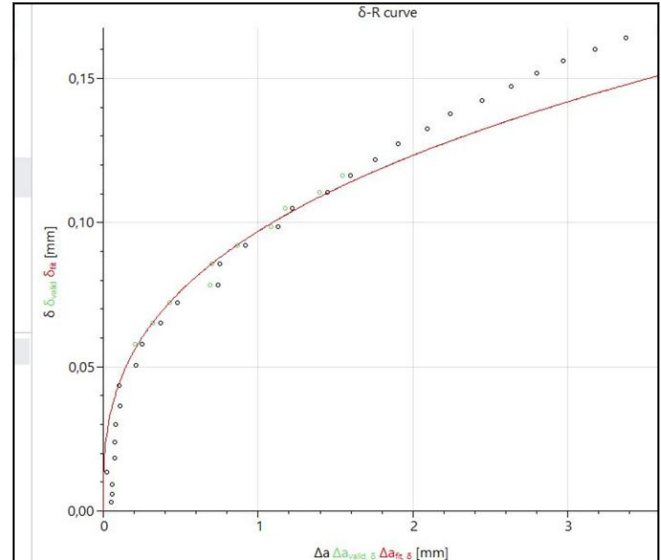
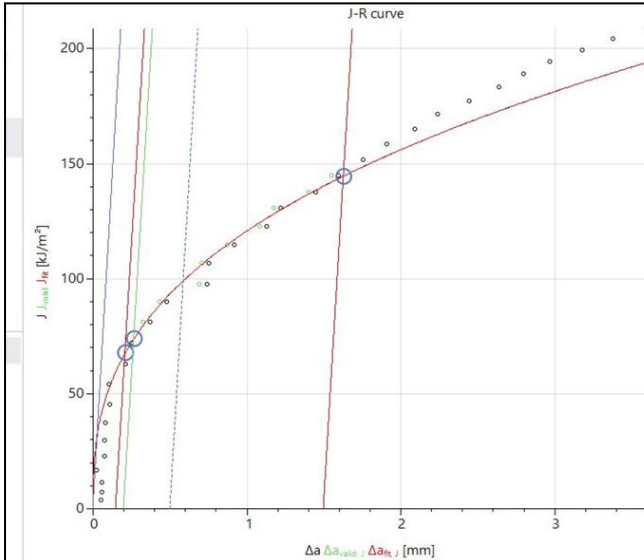
The test is implemented using testXpert Research in accordance with ASTM E1820 as follows:

- Specimen pre-cracking over a constant load level according to section 7.4.4 or two steps according to 7.4.5.1
- Estimation of the initial crack length via compliance calculation according to section 8.6.3.1
- Performance of the tensile test with configurable partial unloading according to section 8.6.3.2
- Display and evaluation of the J-R curve as well as the δ -R curve
- Qualification of the results via validity criteria according to section A9.6.2 / A11.6.4

Product Information

testXpert R Fracture Mechanics Testing Software for Determination of the Fracture Toughness for J1C and CTOD acc. to ASTM E1820

CTA: 300032 300034



Results determined in the J-integral layout:

- Δa_J : Array with crack-growth values (crack length)
- J_{elast} : Array consisting of elastic parts of the J-values (J-integral)
- J_{plast} : Array consisting of plastic parts of the J-values (J-Integral)
- J_{max} : Maximum J-integral capacity
- J_{limit} : Limited J-integral capacity
- $\Delta a_{min, J}$: Intersection of 0.15 mm exclusion line with J- Δa curve
- $\Delta a_{Limit J}$: Intersection of 1.5 mm exclusion line with J- Δa curve
- J_Q : Intersection of 0.2 mm offset line with J- Δa curve
- J_{1C} : Critical J-value for crack length initiation and stable crack growth
- K_{JQ}/K_{J1C} : Stress intensity at J_Q/ J_{1C}

In the diagram:

- J-R curve
- Exclusion lines with $2^*\sigma$ gradient
 - 0 mm construction line
 - 0.15 mm exclusion line
 - 0.2 mm offset line
 - 1.5 mm exclusion line

Results determined in crack tip opening layout δ :

- Δa_δ : Array with crack-growth values (crack length)
- δ : Array of δ -values
- δ_{max} : Maximum crack tip opening
- δ_{limit} : Limited crack tip opening
- $\Delta a_{min, \delta}$: Intersection of 0.15 mm exclusion line with δ - Δa curve
- $\Delta a_{limit \delta}$: Intersection of 1.5 mm exclusion line with δ - Δa curve
- δ_Q : Intersection of 0.2 mm offset line with δ - Δa curve
- δ_{1C} : Critical δ - value for crack initiation and stable crack growth

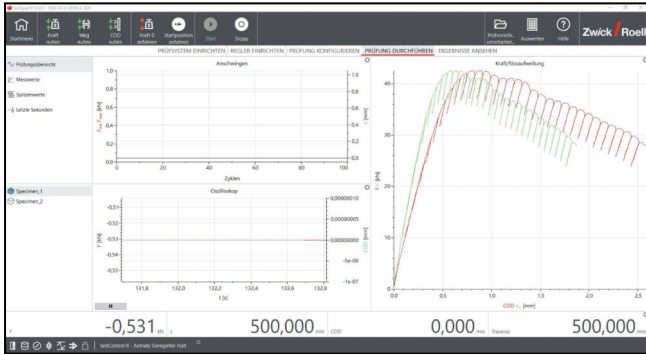
In the diagram:

- δ -R curve
- Exclusion lines with $2^*\sigma$ gradient
 - 0 mm construction line
 - 0.15 mm exclusion line
 - 0.2 mm offset line
 - 1.5 mm exclusion line

Product Information

testXpert R Fracture Mechanics Testing Software for Determination of the Fracture Toughness for J1C and CTOD acc. to ASTM E1820

CTA: 300037 282699



During the test, test data can be observed in an online graph.

A status display shows which block is currently being processed.

The PID settings of the controller, the parameters of the test sequence, and the results are saved together in one file, making this information easily accessible at any time.

All testXpert R test programs are workflow-based and aligned with real workflow processes in the lab. This setup guides the user through the test with logical and traceable steps:

1. Set up testing system
2. Set up controller
3. Configure test
4. Run test
5. View results

This structure, as well as the software interface are almost identical to our testXpert III software for static tests. Training requirements are therefore minimized and laboratory personnel are ready to operate diverse ZwickRoell machine types in a short time.

Description	ArticleNumber
testXpert R test program according to ASTM E1820	3012439
testXpert R Metals industry package – Fracture mechanics includes master test programs for performing the following tests: <ul style="list-style-type: none"> • ASTM E399 (K1C) • ASTM E647 (da/dN) • ASTM E1820 (J1C, CTOD) • ISO 12135 (J1C, CTOD) 	1118638