

## Product Information

testXpert® R fracture mechanics testing software for crack extension curve (K-R curve) determination as per ASTM E561



Middle-crack tension specimen installed



Extensometer on a middle-crack tension specimen

The testXpert Research fracture mechanics testing software is used for determining the crack extension curve (K-R curve) as per ASTM E561-2010 on MT and CT specimens by means of the compliance method.

The K-R curve can be determined for all materials which exhibit slow, stable crack-growth under increasing load. The K-R curve shows the crack extension with stress intensity increasing at intervals.

To determine the K-R curve a fatigue crack is generated in a notched specimen. This pre-cracking of the specimen can be performed with testXpert Research before the test.

The K-R curve is divided into three parts.

1. The steady-state crack region, in which the size of the crack does not alter.
2. The stable crack region, in which the crack extends but the component does not fail. An increase in external loading is necessary for further crack extension.
3. The non-steady-state crack region, in which the crack extends with no increase in load. The transition from stable to non-steady crack region is of particular importance and is also determined.

K-R values are only valid for a defined crack extension.

To verify whether distortion of the specimen has occurred, hysteresis loops can be run during the tensile test. The ratio between the rising and falling branches of the hysteresis must be within defined limits.

### Performing the test:

- pre-cracking up to a defined crack length
- determination of effective Young's modulus  $E_{eff}$
- static tensile test up to specimen break with optional hysteresis loops.

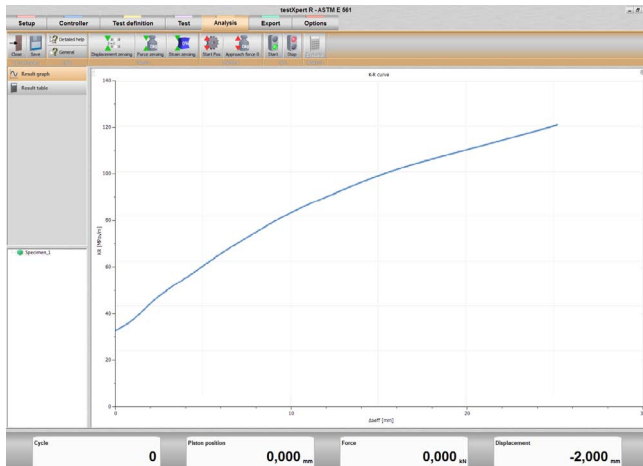
### Result curve

- K-R curve via  $K_R$  and  $\Delta a_{eff}$

The K-R curve is determined using a crack-propagation extensometer and by means of the analytical compliance method.

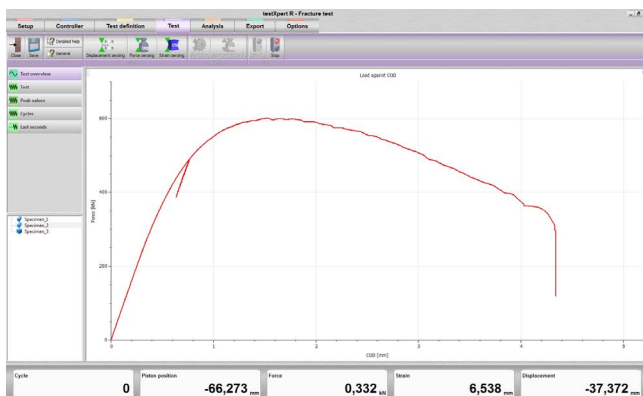
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testXpert Research with K-R curve

Results table for K-R curve



Tensile test up to break with hysteresis at 80% of Fmax



Pre-cracking in steps up to  $K_{max}$

**The results for each point of the K-R curve are presented in a results table:**

- $a_{eff}$  effective crack length
- $\Delta a_{eff}$  change in effective crack length
- $K_{Reff}$  incremental R-curve stress intensity values based on  $a_{eff}$
- $a_{phys}$  physical crack length
- $\Delta a_{phys}$  change in physical crack length
- $K_{Rphys}$  incremental R-curve stress intensity values based on  $a_{phys}$
- $r_Y$  plastic zone adjustment
- $\sigma_{net}$  net section stress
- $K_{app}$  apparent stress intensity based on  $a_0$
- $R_V$  validity check  $\sigma_{net}/R_{p0.2} \leq 1$

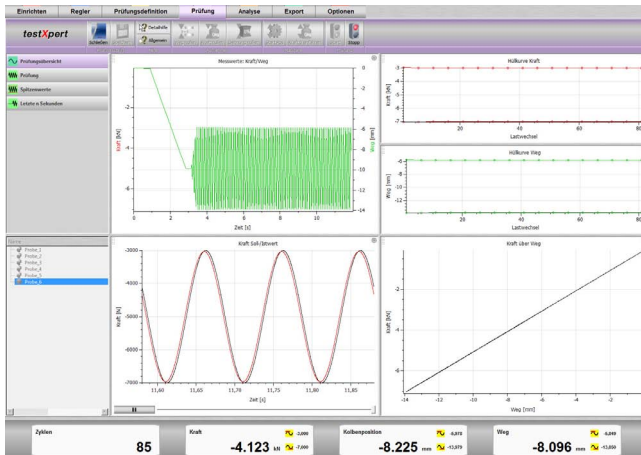
The validated values of  $K_C$  and  $K_{app}$  are displayed.

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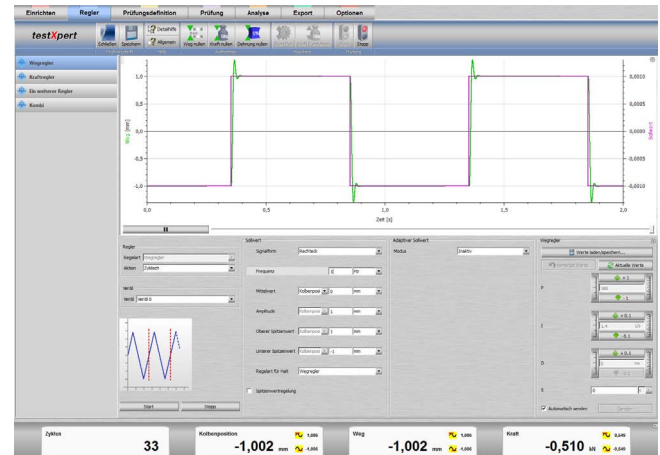
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During the test, test data can be followed in an online graphic.  
A status display shows which block is currently in progress.

The controller PID settings, the test sequence parameters and the results are stored together in one file and in this way remain permanently accessible.



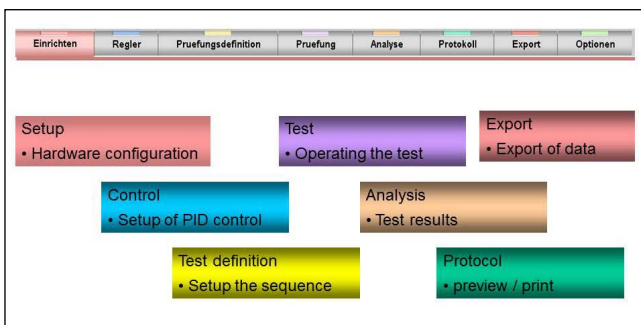
Online graphics and status display



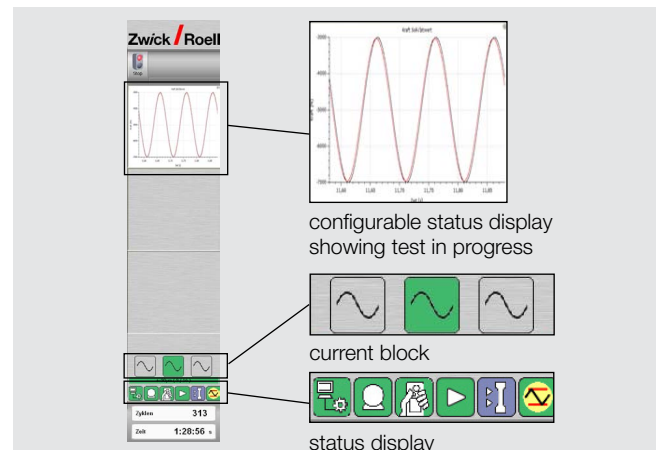
Inputting control parameters

testXpert Research provides integrated software for the entire test sequence, guiding the operator step by step through controller parameterization, the test sequence and result evaluation.

The sidebar with drag and drop function always shows all relevant information in up-to-date form.



Graphical account of user guidance



Sidebar