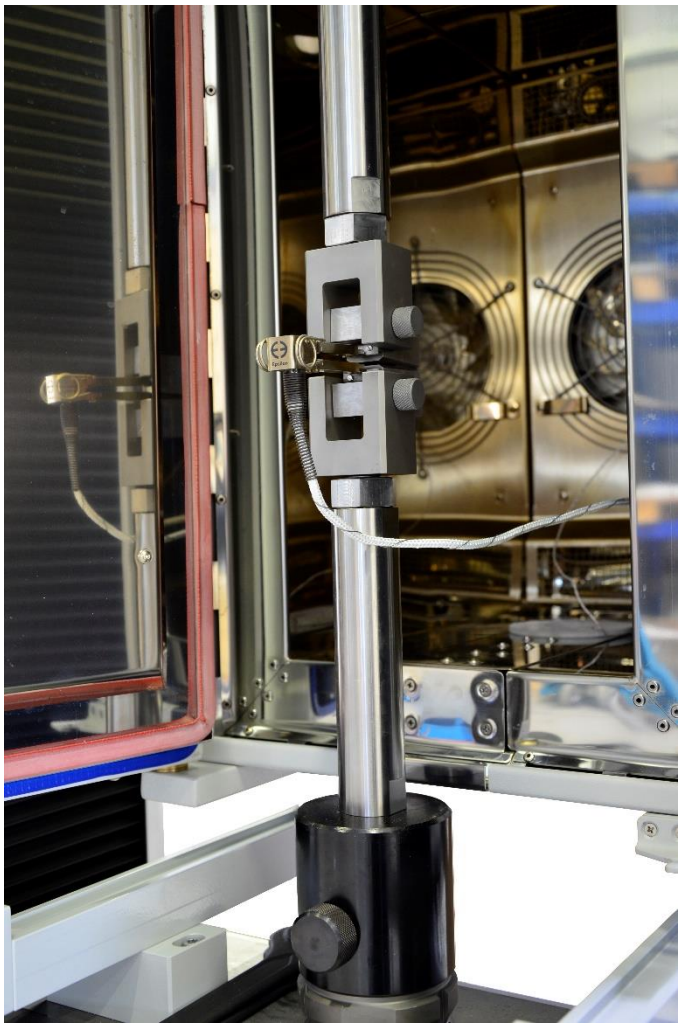
Hegewald & Peschke
Meß- und Prüftechnik GmbH

Product Information

LabMaster
Add-on for Facture Mechanics



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With the LabMaster add-on fracture mechanics, static tests on initially cracked specimen can be carried out. Depending on the material behavior, the linear-elastic fracture mechanics (e.g. K-concept) and elastic-plastic fracture mechanics (J-integral-concept) is distinguished. The corresponding test specifications and procedures are predefined as templates.

Standards that are mapped with the software:

- ASTM E 399
  Standard Test Method for Linear-Elastic Plane-Strain Fracture Toughness KIc of Metallic Materials
- ASTM E1820
  Standard Test Method for Measurement of Fracture Toughness
- ISO12135
  Metallic materials – Unified method of test for the determination of quasistatic fracture toughness

A clip-on extensometer is used to measure notch expansion. The crack length is determined according to the compliance method.

Execution of the test utilizing the J-Integral concept (single specimen test method) according to ASTM E1820

Depending on the specimen shape, a distinction is made between a tensile load (CT specimen - compact tensile specimen; DCT specimen - disc-shaped compact tensile specimen) and a bending load (SENB = Single Edge Notched Bending specimen).

Before starting the test, the following specimen data are entered

- Specimen shape: Selection of predefined specimen shape -> insertion of schematic drawing with labelling of specimen dimensions (W, B, BN, anotch)
- Mechanical parameter (strength values, modulus of elasticity (Youngs modulus), stress intensity factor of the last cyclical oscillation stage)
- Test conditions (e.g. temperature)

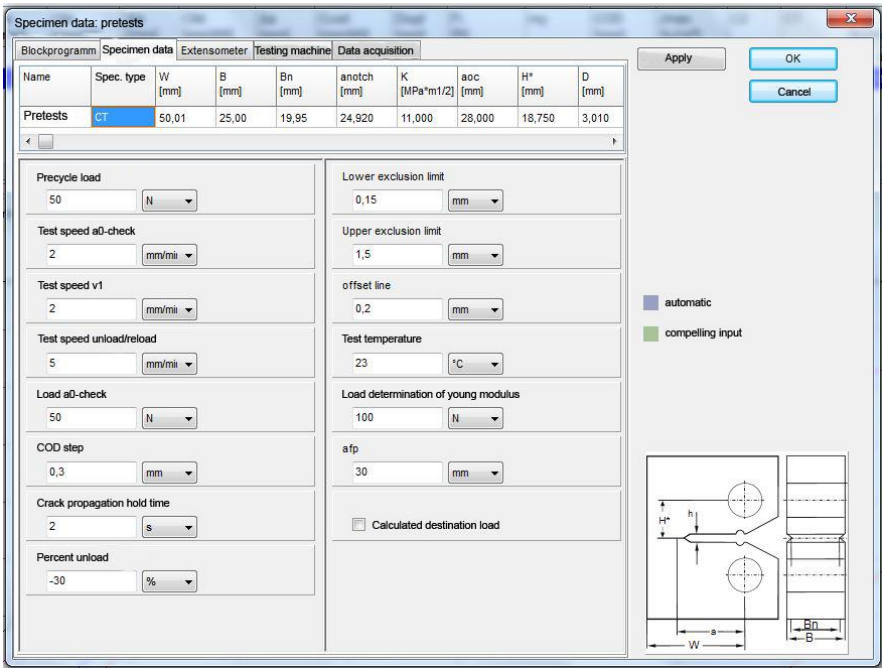

Fig.1: Input of the specimen data depending on the specimen geometry and parameterization of the test procedure

Your contact person:

Parameterization and test procedure

- Preloading of the specimen to determine the crack length
- Partial unloading (increment, holding times, loading and unloading cycles)
- End of test (e.g. COD, delta a, load decrease)

Tests | a0-check | J-R-Test

	K [MPa*m1/2]	a [mm]	Δa [mm]	Ccod [mm/kN]	rxy	aktiv
1	20,523	26,546	-1,454	0,01002	0,99988	☑
2	20,561	26,583	-1,417	0,01006	0,99983	☑
3	20,494	26,532	-1,468	0,01000	0,99987	☑
4	20,571	26,592	-1,408	0,01007	0,99988	☑
MW	20,537	26,563	-1,437	0,01004	0,99987	
s	0,036	0,029	0,029	0,00003	0,00002	

Fig.2: Preloading of the specimen to determine the crack length ("crack length check")

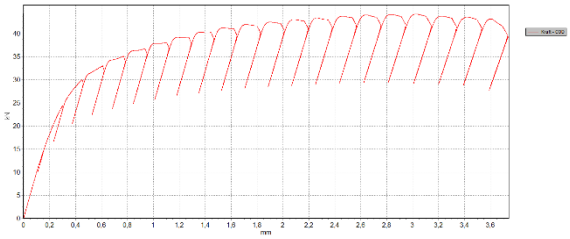

Fig.3: Partial reliefs in the force/load displacement diagram

Versuche | a0-check | J-R-Test

	J [kJ/m²]	K [MPa*m1/2]	Apl [Nm]	a [mm]	Clld [mm/kN]	Δa [mm]	Ccod [mm/kN]	Displ [mm]	Fi [N]	COD [mm]	rxy
1	4,967	30,701	0,042	26,495	0,00998	-0,068	0,00996	0,152	14433,300	0,15150	0,99990
2	18,320	52,138	0,960	26,572	0,01006	0,008	0,01003	0,300	24389,100	0,30006	0,99995
3	37,825	64,111	3,557	26,575	0,01006	0,011	0,01002	0,452	29983,900	0,45194	0,99992
4	61,337	76,662	7,538	26,615	0,01010	0,052	0,01005	0,610	32968,699	0,60964	0,99993
5	87,285	75,489	12,239	26,680	0,01017	0,117	0,01010	0,772	35060,398	0,77159	0,99993
6	115,376	79,174	17,505	26,718	0,01021	0,155	0,01013	0,936	36679,500	0,93635	0,99993
7	144,837	82,501	23,102	26,793	0,01029	0,230	0,01019	1,103	38029,500	1,10304	0,99993
8	175,834	85,301	29,127	26,838	0,01034	0,274	0,01022	1,273	39204,301	1,27303	0,99990
9	208,322	87,779	35,479	26,888	0,01039	0,324	0,01026	1,446	40208,699	1,44556	0,99991
10	241,655	90,091	42,098	26,966	0,01048	0,403	0,01033	1,621	41052,199	1,62076	0,99991
11	275,046	92,339	48,931	27,111	0,01064	0,548	0,01047	1,799	41666,000	1,79915	0,99988
12	310,654	94,121	56,154	27,206	0,01075	0,643	0,01056	1,982	42199,398	1,98158	0,99988
13	346,430	95,976	63,457	27,315	0,01087	0,752	0,01067	2,164	42712,199	2,16446	0,99986
14	382,285	97,379	70,971	27,448	0,01103	0,885	0,01080	2,349	42944,199	2,34908	0,99986
15	419,604	99,098	78,565	27,544	0,01114	0,980	0,01089	2,535	43415,199	2,53506	0,99988
16	456,007	100,305	86,320	27,687	0,01131	1,124	0,01104	2,722	43510,699	2,72206	0,99986
17	493,318	101,662	94,186	27,819	0,01148	1,256	0,01118	2,912	43694,500	2,91162	0,99986
18	528,427	103,178	102,027	28,026	0,01174	1,463	0,01142	3,103	43704,801	3,10255	0,99984
19	565,338	103,685	110,387	28,222	0,01199	1,658	0,01165	3,301	43314,199	3,30108	0,99984
20	601,151	104,414	118,461	28,410	0,01224	1,846	0,01187	3,495	43034,898	3,49549	0,99983

Fig.4: Tabular representation of the individual partial unloading steps

crack resistance curve

The crack resistance curve is automatically generated and displayed as a real-time graphic during the test. The individual partial unloading steps, the automatic evaluation of the characteristic values with validity criteria and the results are also provided on the screen.

At the end of the test, the optically determined crack length is entered.

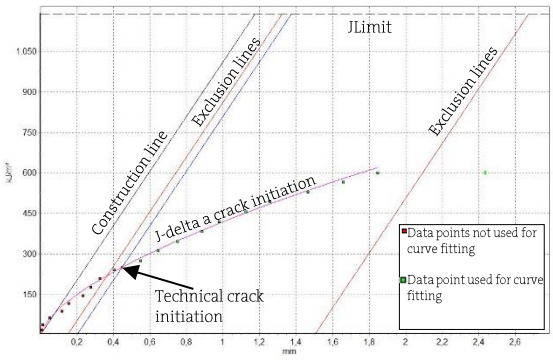

Fig.5: crack resistance curve

Experimental execution of the K-concept

Depending on the type of specimen, either a tensile test or a bending test is carried out at constant speed. The preload and the speed can be defined. Furthermore, the end of the test criteria can be freely defined.

The following results can be obtained in the KIc test:

- Elastic proportion, critical force - P/V; PQ
- Stress intensity factor - KQ
- Fracture toughness - KIC
- K1 with critical force
- Ratio of stress intensity to Rp0.2
- Maximum force to critical force ratio
- Strength ratio - Rsx
- Output of Xs and X1, strain distance at critical force (Xs) and strain distance at 80% of critical force
- Input of the 5 optically determined crack lengths

Your contact person: