

FATIGUE CRACK GROWTH TESTS ON AUSTENITIC STAINLESS STEEL IN CORROSIVE ENVIRONMENT AT ELEVATED TEMPERATURE

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The aims of the research work

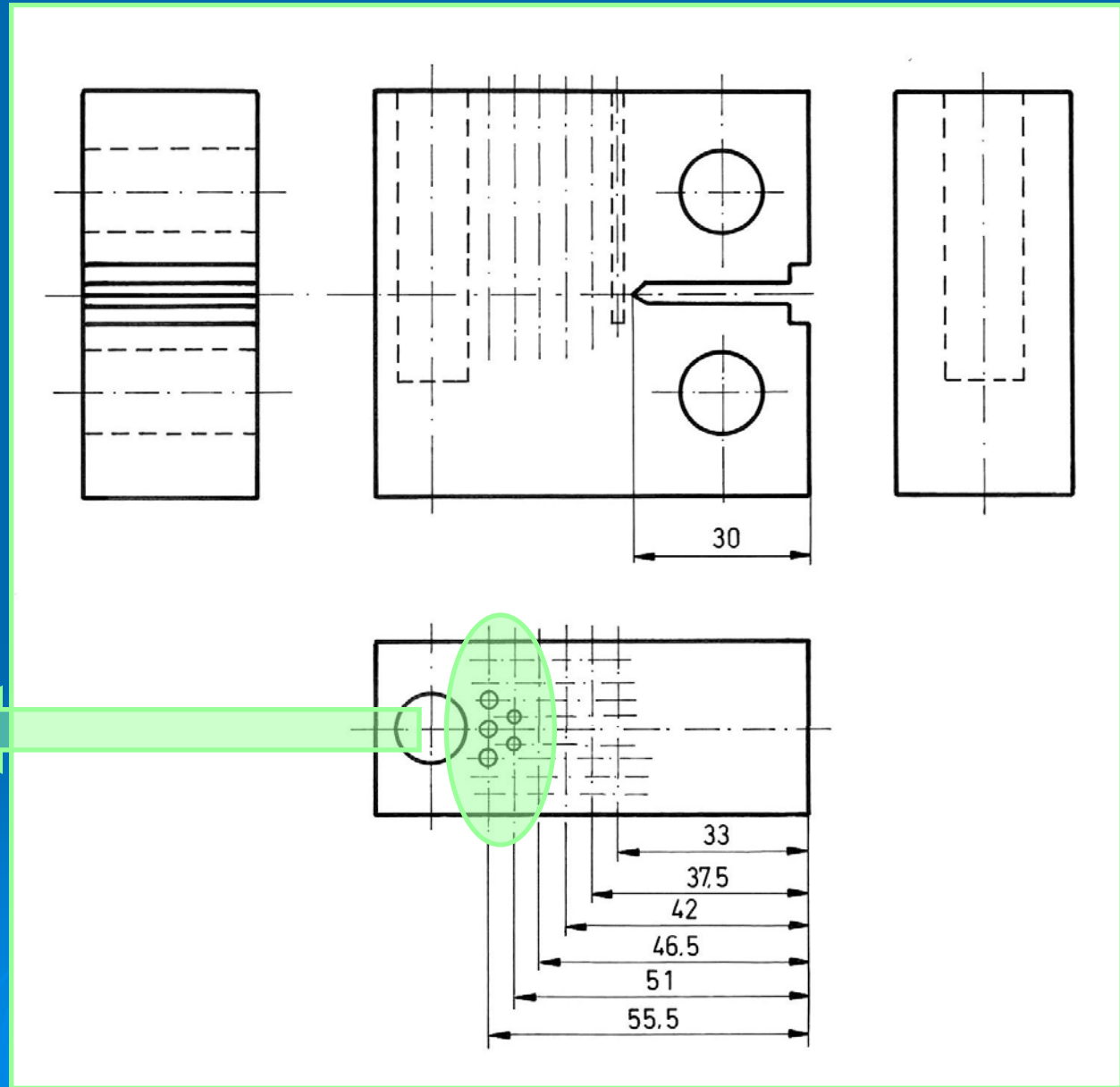
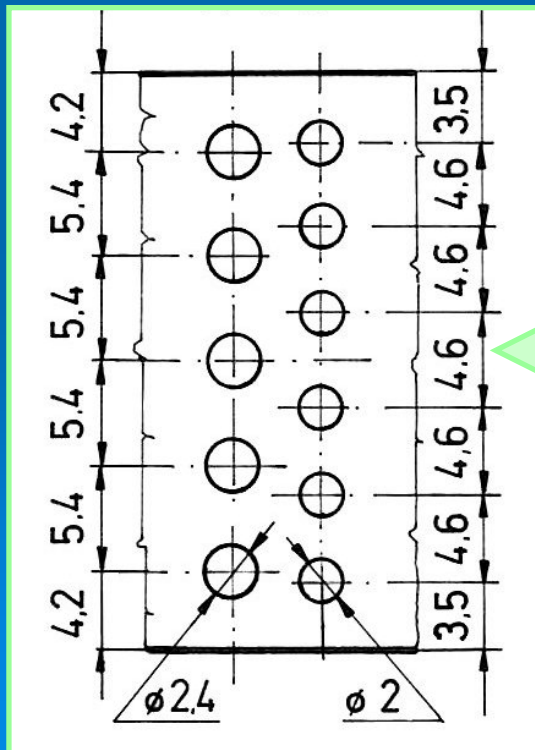
- ✓ To measure basic data for fatigue crack propagation limit curves on austenitic stainless steel (type 321), in corrosive environment and at elevated temperature
- ✓ To determine the design curves based on statistical analysis of measured data and fatigue crack propagation law (Paris-Erdogan law)
- ✓ To study the crack behaviour during a hold time on fatigue crack propagation

Test characteristics

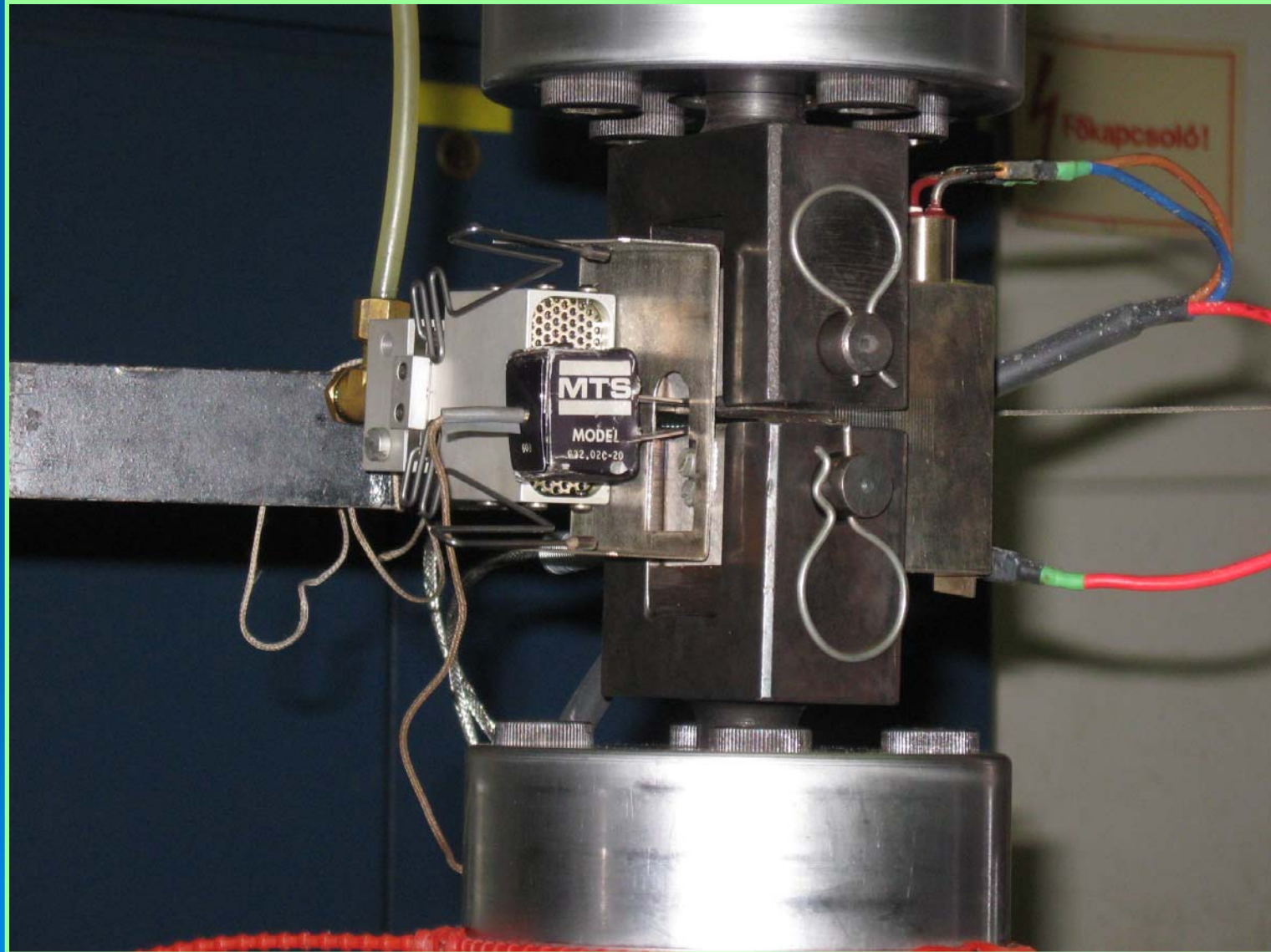
- ✓ Material: 08H18N10T austenitic stainless steel (type 321)
- ✓ Environment: water solution (30 g $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ + 10 g NaCl + 3 g NaOH in 1000 ml water)
- ✓ Specimen type: CT with parallel holes

Specimen	Test temperature, °C	Hold time
FCG1_100	100	–
FCG2_300_100	300 → 100	–
FCG6_100	100	–
FCG7_100_3h	100	3 hours
FCG4_300	300	–
FCG5_290	290	–
FCG3_290	290	–
FCG8_290_3h	290	3 hours

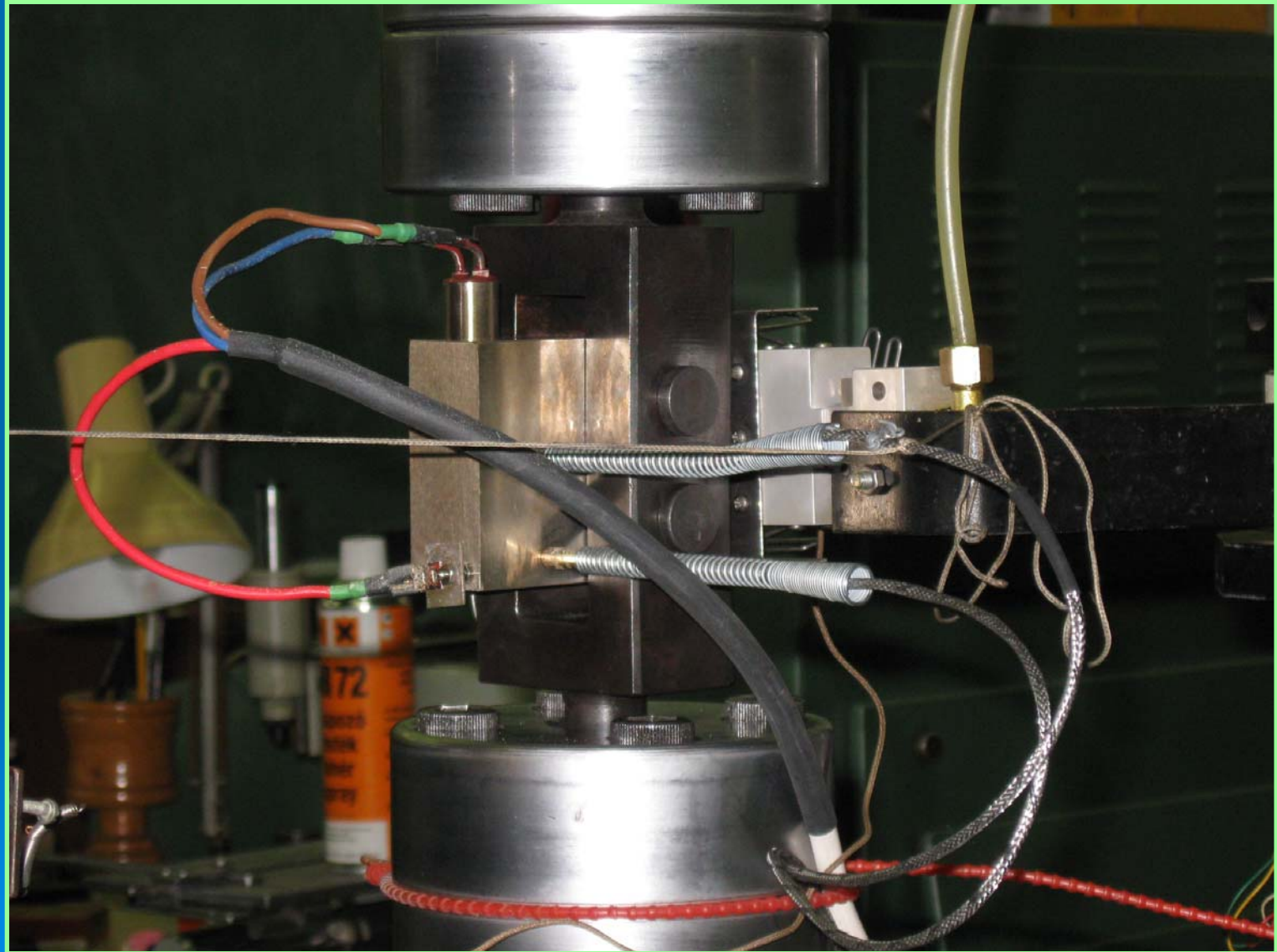
Type and dimensions of specimens



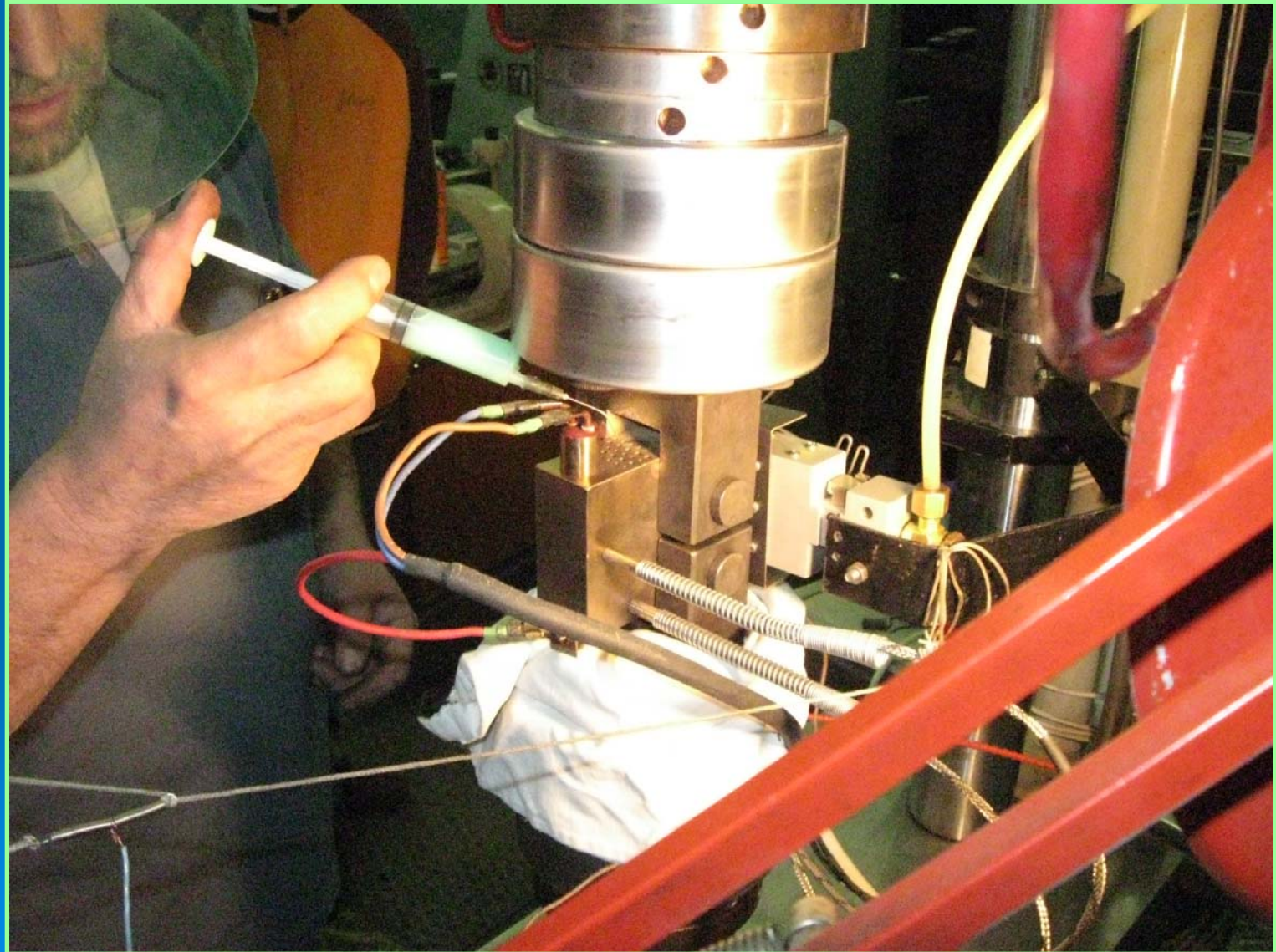
Examination arrangement (front)



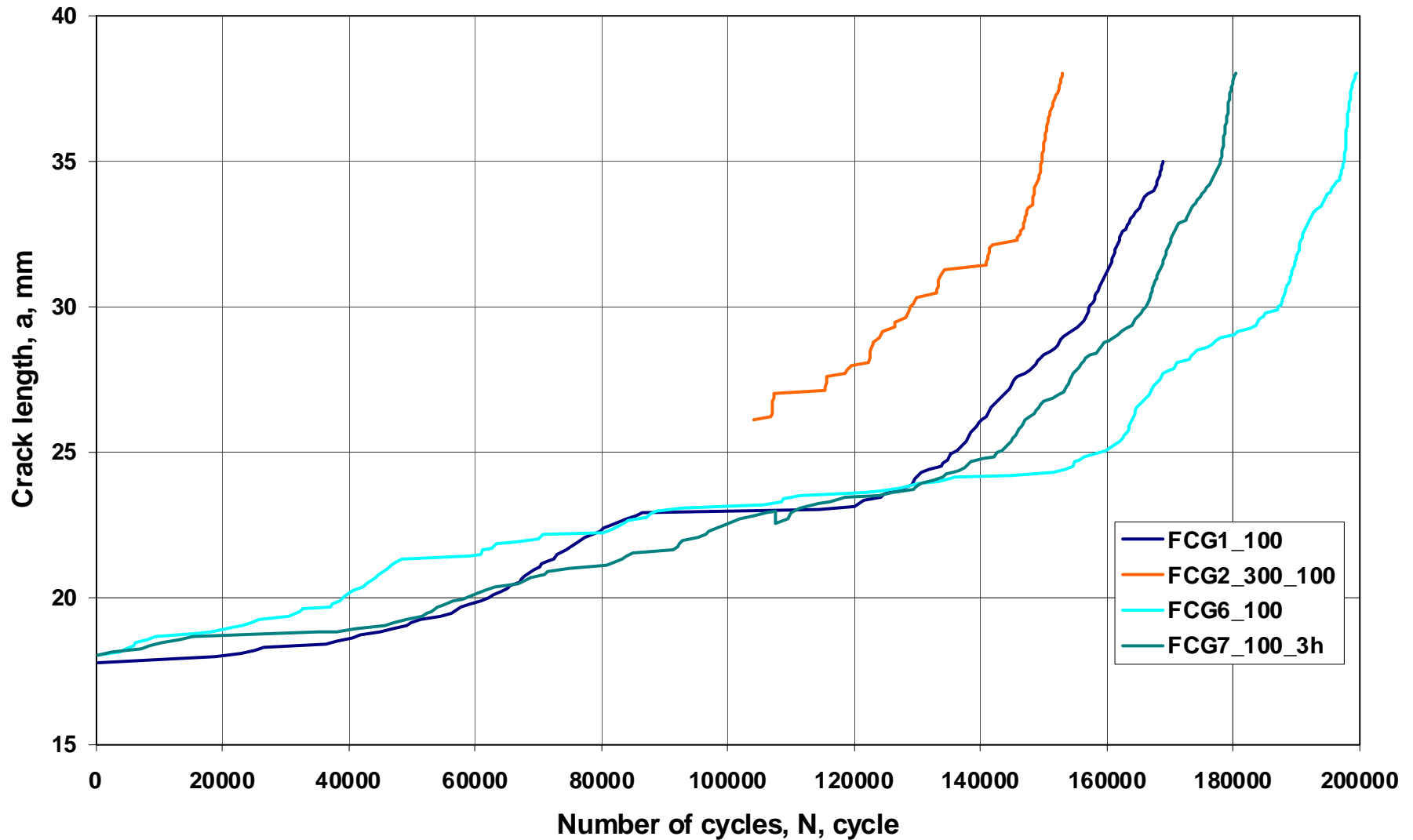
Examination arrangement (back)



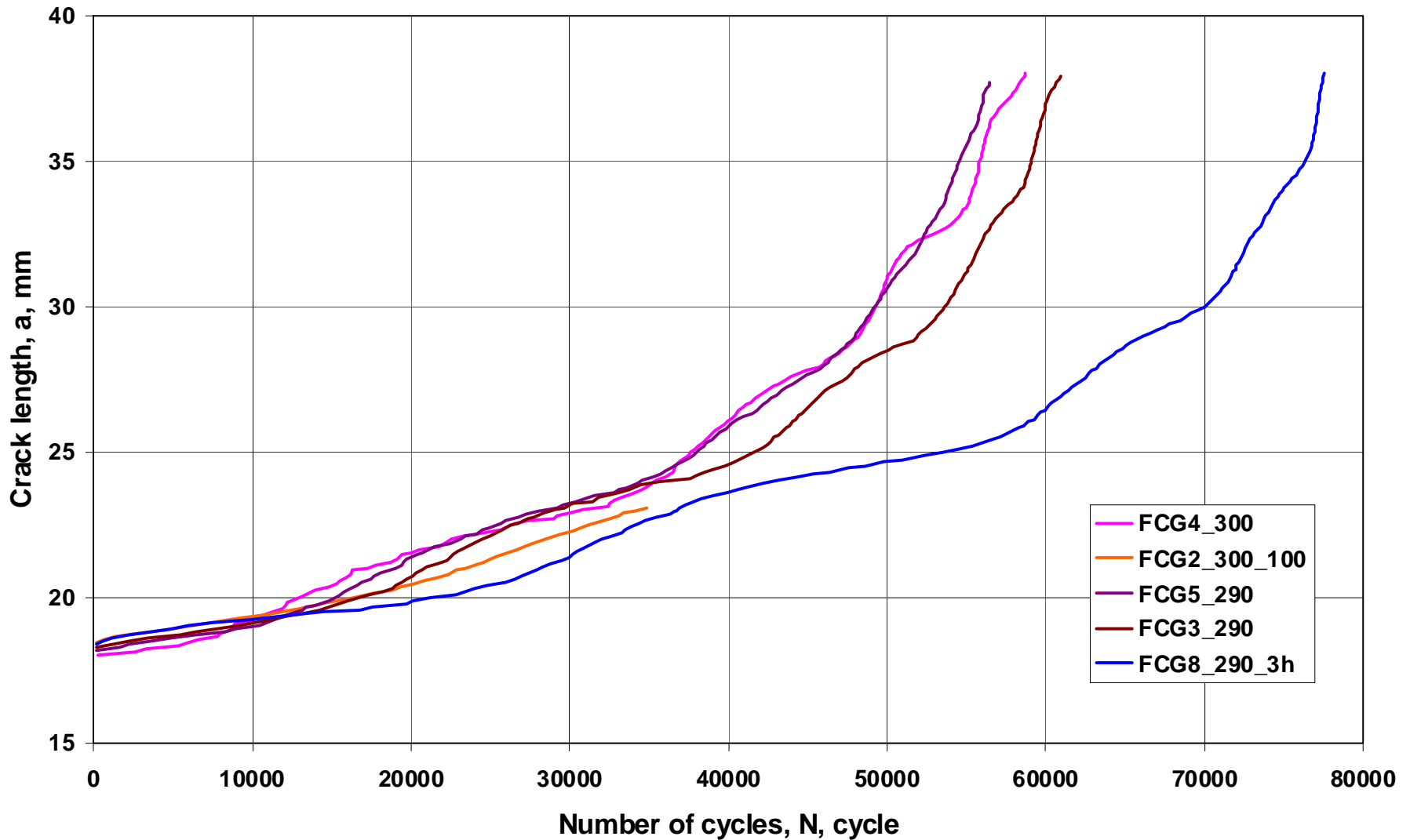
Injection of the corrosive environment



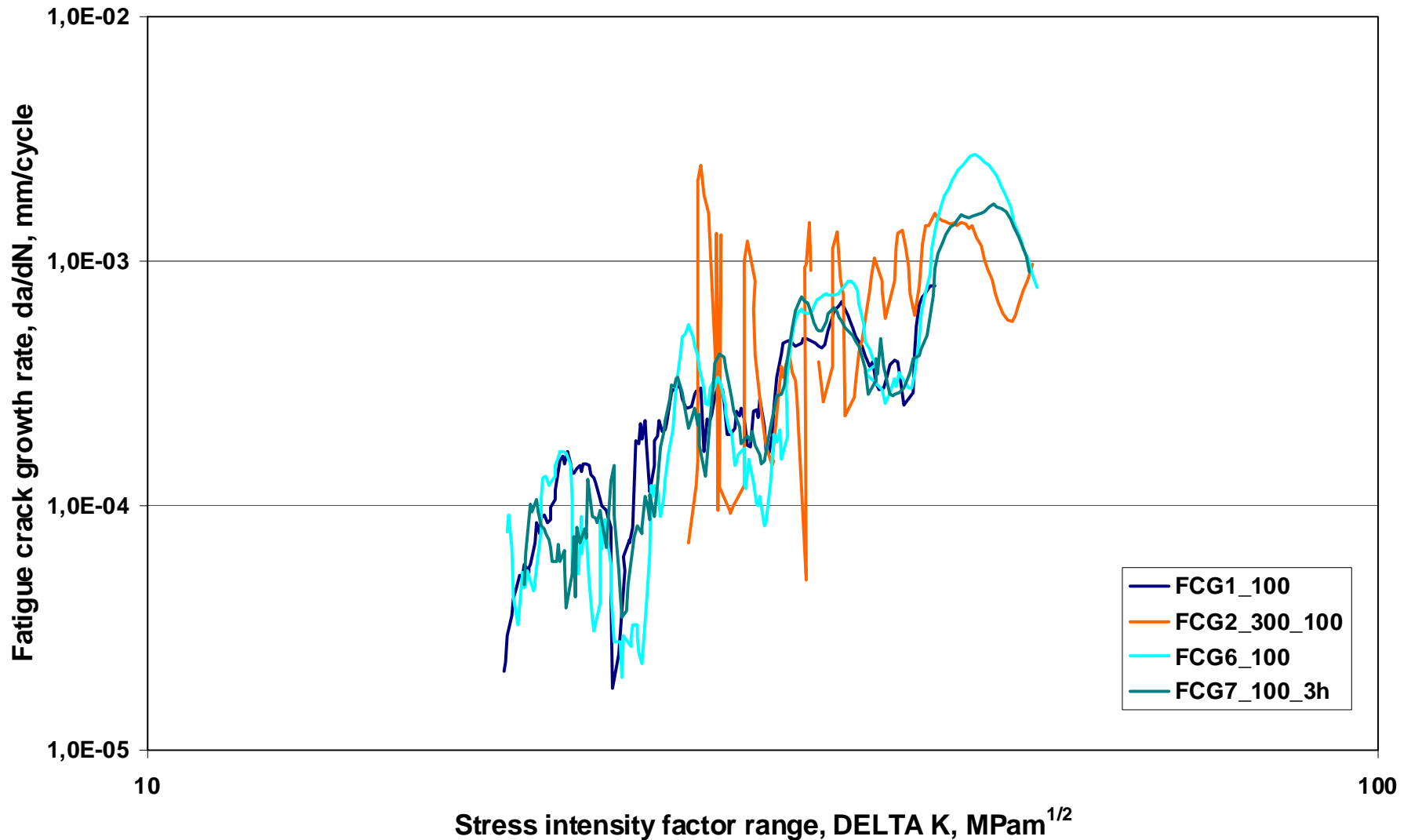
Crack length vs. number of cycles at 100 °C



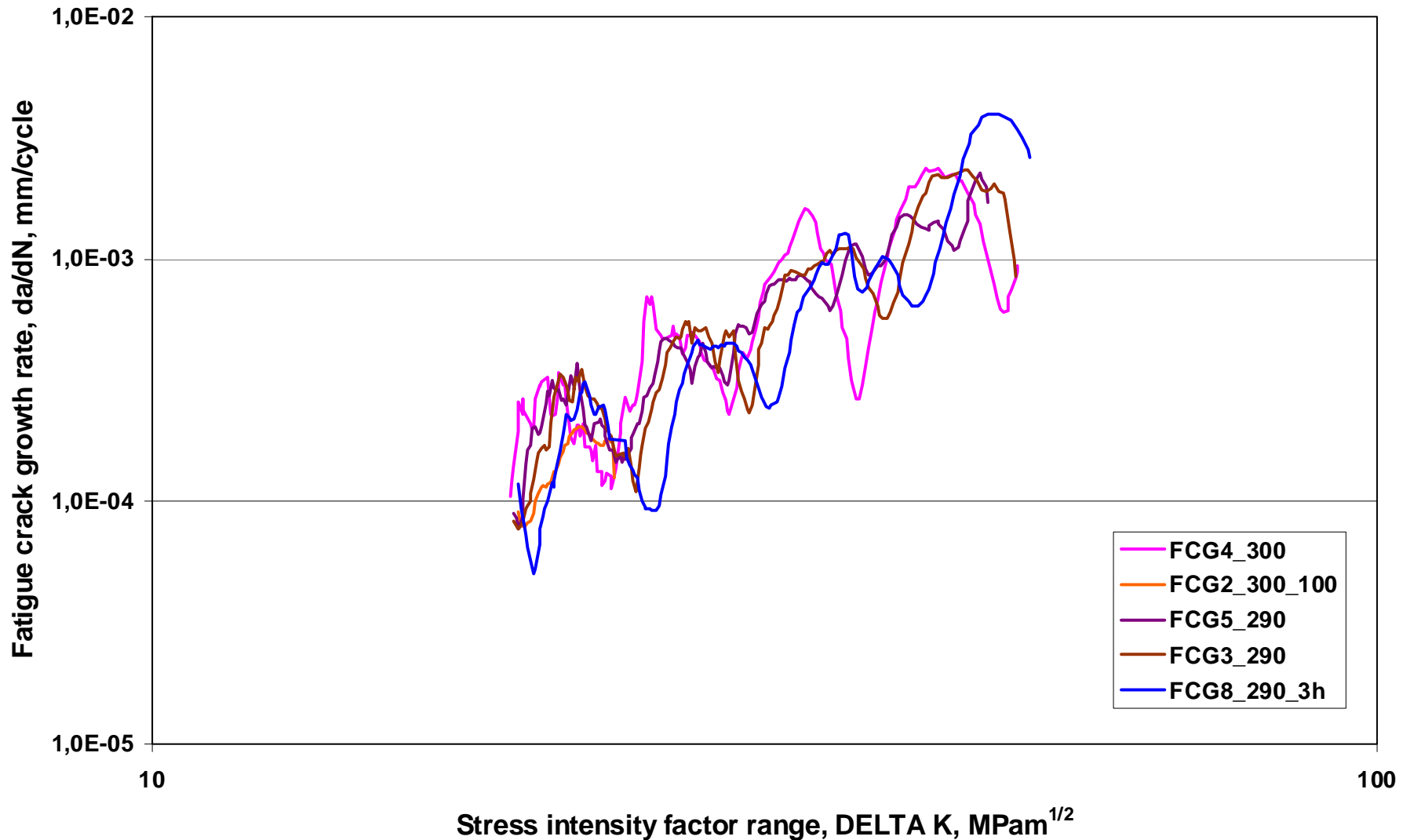
Crack length vs. number of cycles at 300 °C



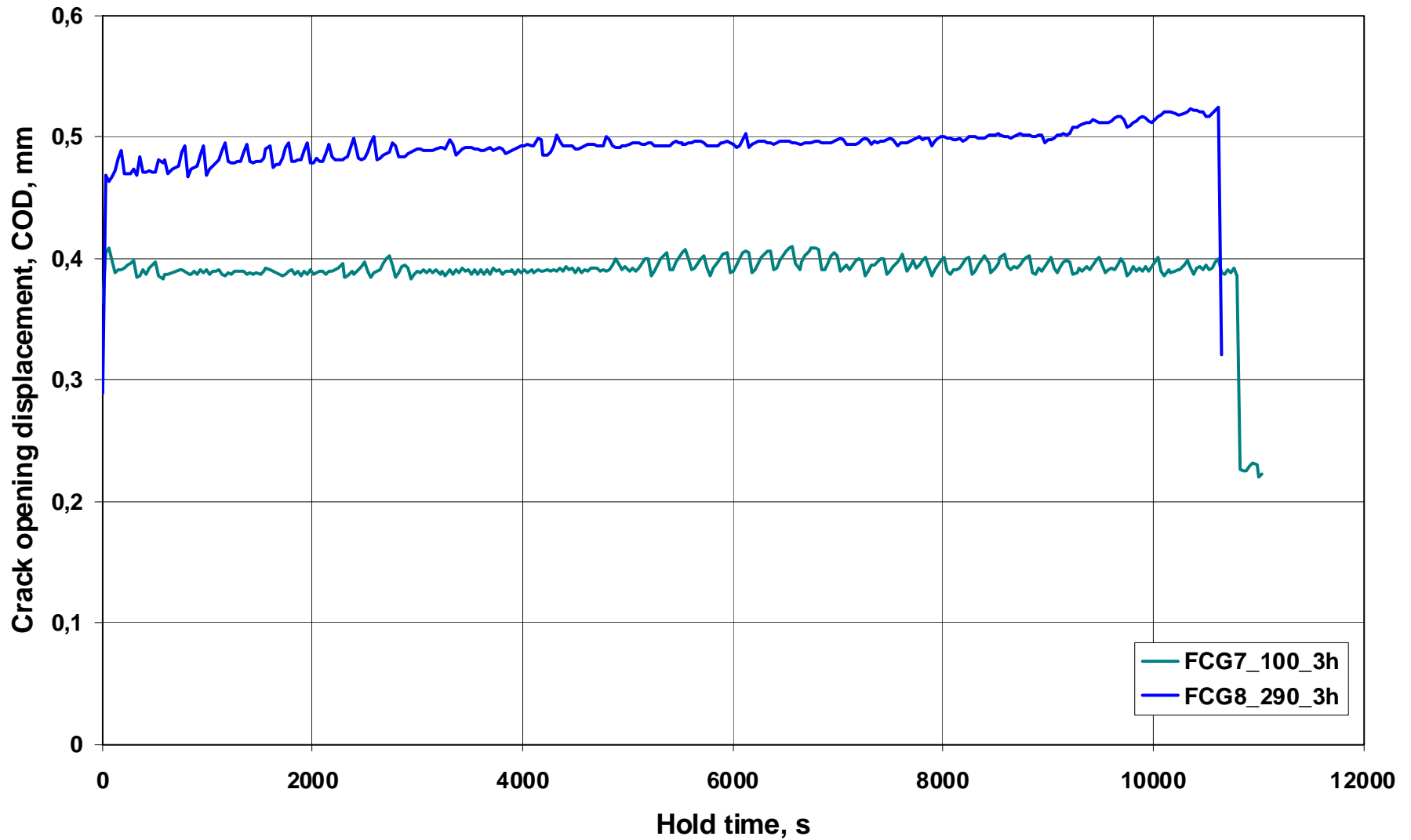
Fatigue crack propagation curves at 100 °C



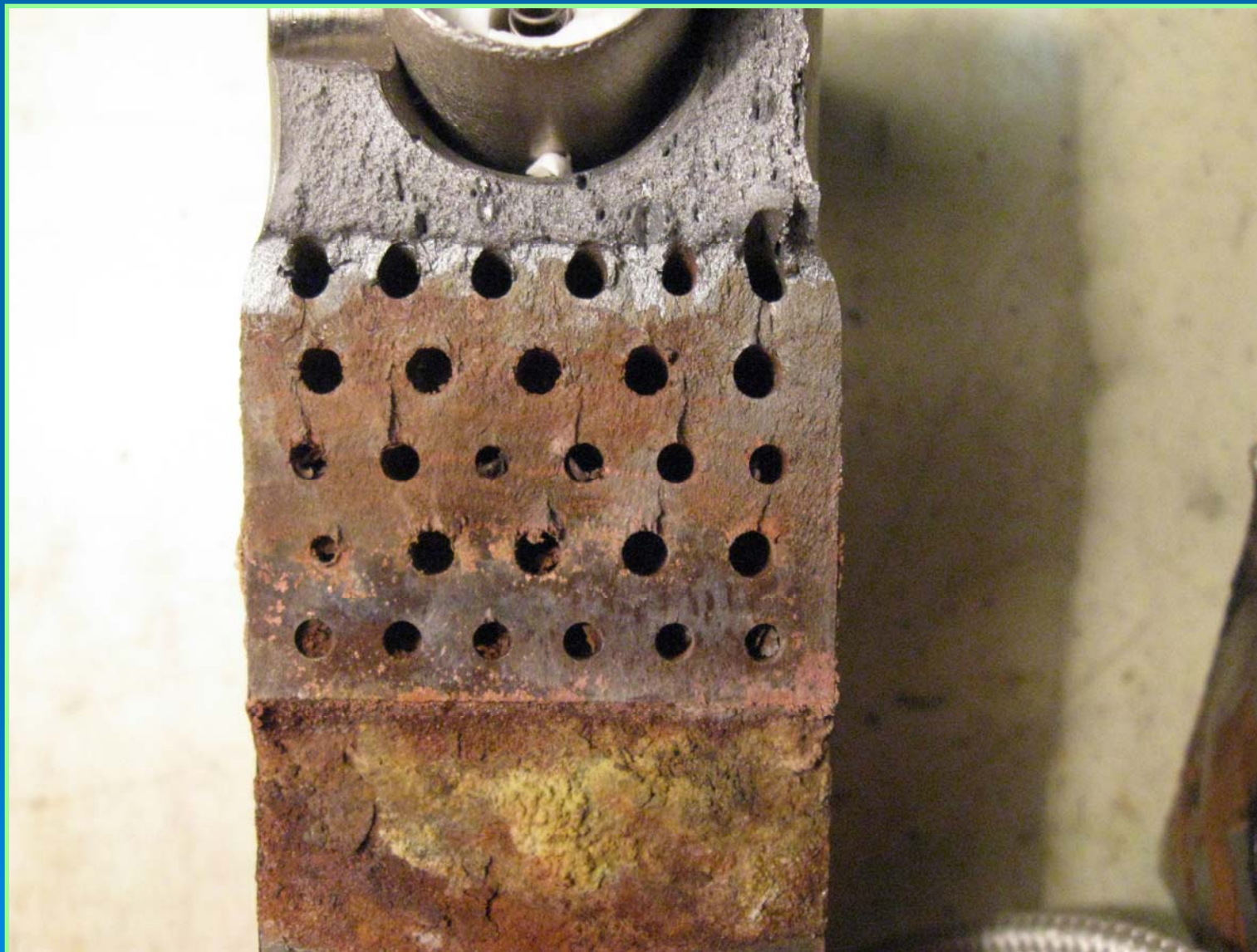
Fatigue crack propagation curves at 300 °C



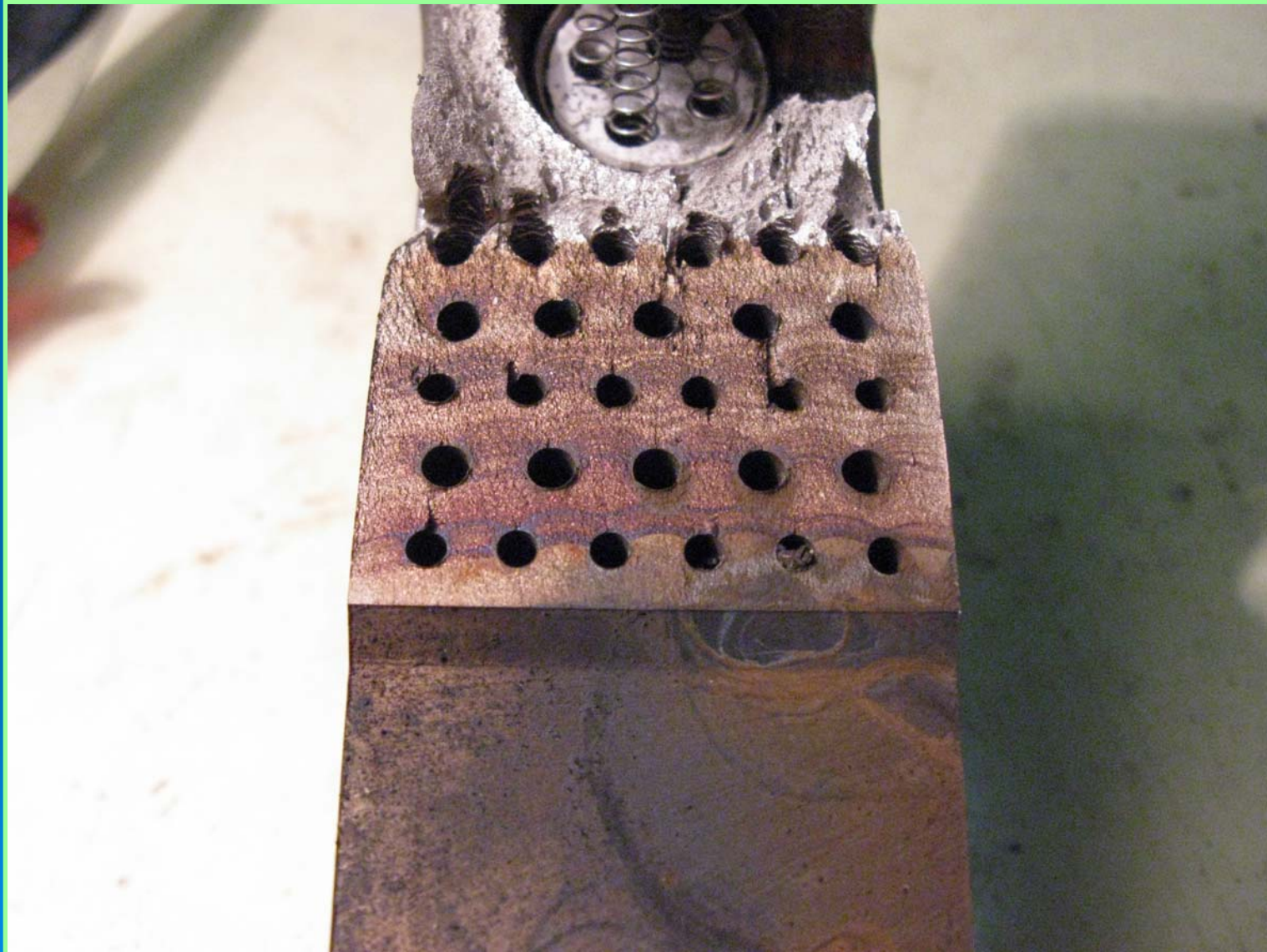
COD during hold time



Fracture surface of the FCG7_100_3h specimen



Fracture surface of the FCG8_290_3h specimen



The constants of the Paris-Erdogan law

Specimen number	C	n	Correlation coefficient
	MPam ^{1/2} , mm/cycle		
FCG1_100	8,079E-09	3,022	0,8447
FCG2_300_100	2,502E-07	2,147	0,4591
FCG6_100	5,084E-10	3,812	0,8374
FCG7_100_3h	1,578E-09	3,488	0,9071
FCG4_300	1,617E-07	2,353	0,7899
FCG2_300_100	–	–	–
FCG5_290	2,705E-08	2,880	0,9433
FCG3_290	1,834E-08	2,984	0,9085
FCG8_290_3h	2,131E-09	3,555	0,9096

Conclusions

- ✓ The constants of the Paris-Erdogan law correctly describe the fatigue crack propagation measured on CT specimens with parallel holes.
- ✓ The fatigue crack propagation characteristics were different at different testing temperatures.
- ✓ Stable crack propagation and/or crack tip blunting can be detected during the hold time at 300 °C testing temperature.

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