WHEN DO SMALL FATIGUE CRACKS PROPAGATE AND WHEN ARE THEY ARRESTED?

Stefanie E. Stanzl-Tschegg, University of Natural Resources and Life Sciences, BOKU Vienna
Stefanie.tschegg@boku.ac.at

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Mainly the role of the following parameters is treated:

- material (steels, Al-alloys, Cu – heat treatment),
- kind of loading (stress range, R-ratio, mode I, mixed mode loading, constant and variable amplitudes, 10 Hz, 20 kHz)
- environment (vacuum, humid air at 20 °C, dry air at 90 °C, aqueous solution with different Cl^--concentration
- initial defect size (small-crack length, voids, inclusions, corrosion-pit size, PSBs),

Different evaluation procedures were developed, and for a better understanding of the relevant mechanisms. Initiation and growth of small and long cracks were measured. The results are correlated with microscopic surface observations, and SEM fracture analysis is used for a quantification of crack initiation, propagation and arrest mechanisms. The two-parameter model of Vasudevan and Sadananda is applied besides other models (Kitagawa-Takahashi, El Haddad) for realistic life-time predictions. They help to reduce costs for extensive tests and also material and thus weight of machine parts and constructions.

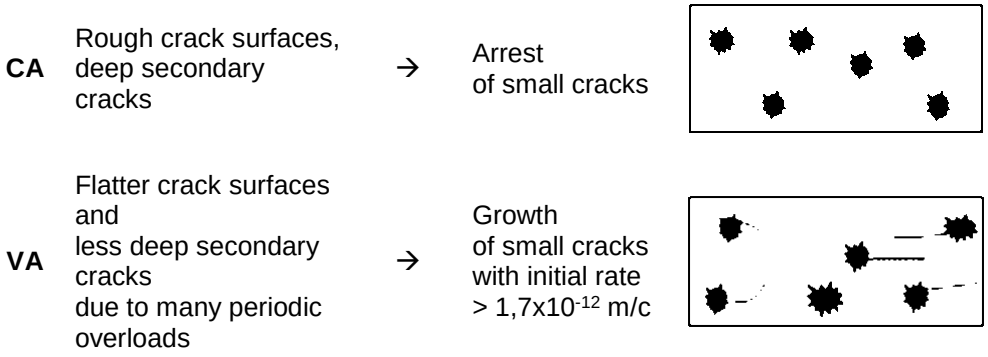

Figure 1 – Role of crack surface roughness on growth of small cracks at CA and VA fatigue loading