B. INTRODUCTION TO EAC ASSESSMENT PROCEDURES

Flaw in EAC should be treated with extreme caution. The following aspects should be considered:

1. If a material remains in aggressive environment in service, the cracks may growth by what is know subcritical crack growth if the applied K is above the threshold K_{TH}, the flaw will growth until the applied K exceed a value for the K_R curve, at which time unstable fracture will occur.

2. Long exposure to hydrogen or other damaging environment may produce irreversible damage in the material. The apparent toughness could fall below the K_R curve in such cases.

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ASSESSMENT OF ENVIRONMENTAL ASSISTED CRACKING

SCC assessment: σ and K based approaches

The growth law should be derived to fit the relevant data but often take the form:

$$da/dt = f(K_I) \qquad \text{if } K_I \geq K_{ISCC}$$

Contrarily, no crack propagation occurs if $K_I < K_{ISCC}$

The existence of a "maximum" effective initial defect (a_{0eff}) due to the surface finishing of the material or the design or fabrication conditions of the component, is associated to the existence of some threshold conditions σ_{scc} to avoid crack propagation due to SCC, related with the material and the geometrical conditions including surface finishing or maximum defect.

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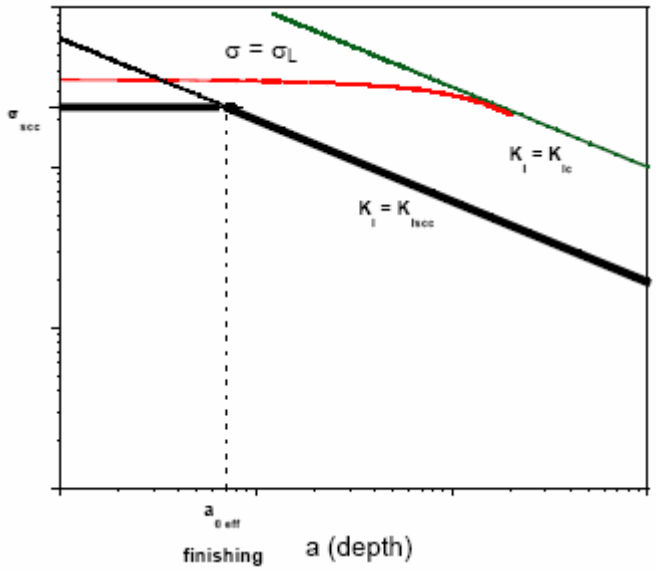
SCC assessment: σ and K based approaches (cont.)

The figure shows in a stress-crack depth (a) plot that the condition of σ_{scc} as a threshold stress could be linked to and effective crack like a_{0eff} value, from where a K_I approach can be done. Once the crack starts to grow (increasing *a* value), the local conditions in the material defining the threshold justify that lower stress values than σ_{scc} produce crack propagation. Therefore, the limit to define non growing conditions for existing cracks of any size a, is the $K_I=K_{ISCC}$ line. For higher σ values than those defined by this line, cracks will grow until fracture ($K_I=K_{IC}$) or plastic collapse occur.



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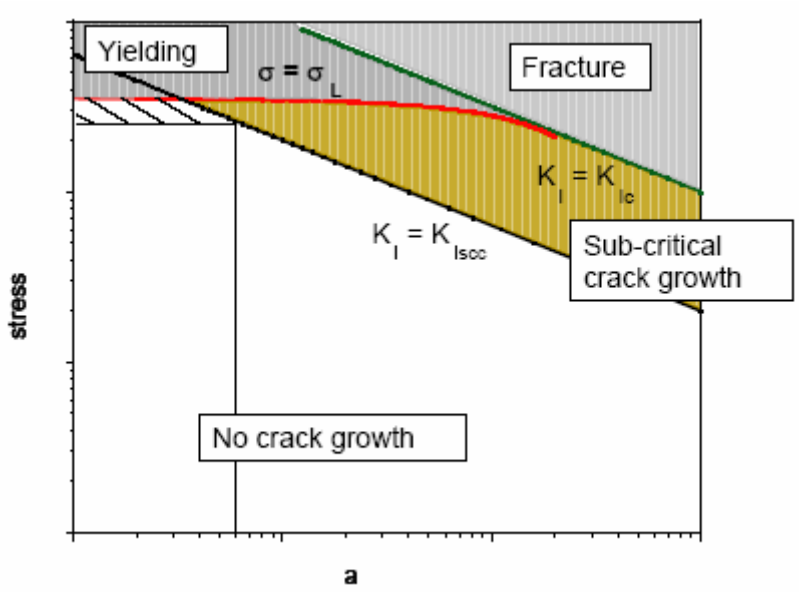
SCC assessment: σ and K based approaches (cont.)

The following Figure shows in the same plot the different regimes related to the stress corrosion cracking in a particular component:

•No crack growth area under the threshold line (K_I-K_{ISCC});

•The sub-critical crack growth area over the threshold line, limited by the fracture region defined by the K_I=K_{IC} line and the plastic collapse one defined by the σ =σ_{LL} line.



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SCC assessment: σ and K based approaches (cont.)

The two previous plots depend on the geometry of the component and the geometry and position of the defects. Therefore, it would be better to define an universal graphic assessment (valid for any component).

In such a case a K_I based analysis, instead of a σ based one, should be considered. Therefore, the same areas and conditions with regarding to cracking can be represented in a FAD, K_r-L_r plot.

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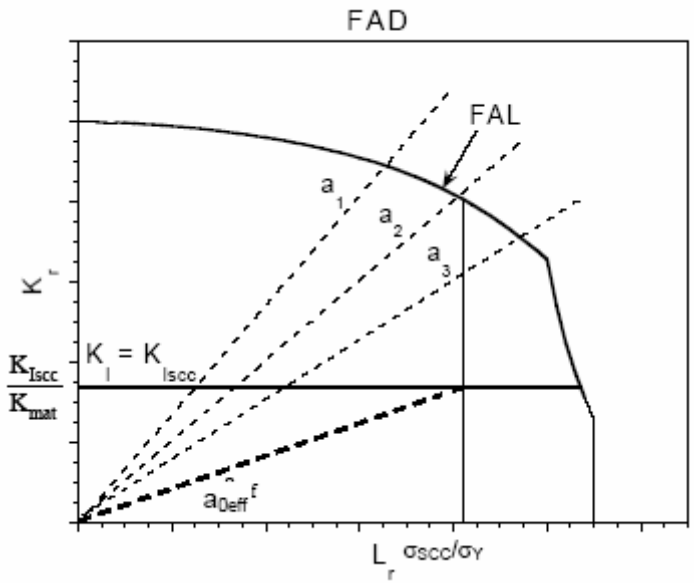
SCC assessment: σ and K based approaches (cont.)

In the Figure, it can be observed that K_I-K_{ISCC} is a horizontal line. Above that line cracks will propagate due to environmental assisted cracking independently of the component geometry and crack conditions.

Each particular case, identified by its a_{0eff} defect condition and the corresponding σ_{scc} value is also plotted, but this value is only relevant for it, not for other component.



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