UNIFIED APPROACH TO CRACK GROWTH AND FRACTURE

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Unified approach connects the behavior of a smooth specimen, of a notched specimen and of the fracture-mechanics specimen, under inert and corrosive environments, using the unifying principles and the Modified Kitagawa-Takahashi Diagram. The unifying principles are based on the fact that the behavior of short cracks is not different from that of long cracks, and the same thresholds govern the crack growth. Cracks being high energy defects, local internal stresses are required to initiate and grow the cracks in all cases. The internal stresses can be pre-existing as in the case of long cracks or in situ generated or augmented in the case of smooth and notched specimens. Observed variations in the crack growth rates of short cracks from those of long cracks arise due to variations in the types and degrees of pre-existing internal stresses. In aggressive environments, chemical forces provide additional driving forces over and above the mechanical forces. Chemical forces come from the chemical and/or electro chemical potential gradients which may be difficult to determine as they depend on the nature and the extent of the local chemical reactions in the changing compositional gradients. From practical considerations, we show that they can be quantified using the inert medium as a reference. Cyclic loads provides additional factors since crack tip driving forces come from both monotonic and cyclic loads leading to load-ratio R dependence. We provide here a systematic analysis of these factors using our Unified Approach to help in quantification and codification of the kinetics of the crack growth and fracture.