

FRACTURE TOUGHNESS K_{1c} AFFECTING STATIC THRESHOLD K_{1scc}

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It is common to observe that monotonic K_{1c} (lab air) and K_{1scc} (NaCl solution) decrease with increasing YS of an alloy. K_{1c} is measured in Lab Air and K_{1scc} in an aqueous solution such as NaCl. It is noted that K_{1c} is not considered as a subcritical parameter while K_{1scc} is. Interestingly, for a given alloy, both these parameters seem to be inter-related. That is, K_{1scc} is linearly related to K_{1c} , such that K_{1scc} increases with increasing K_{1c} . This may indicate that plasticity is affecting the K_{1scc} behavior. This article looks into the conditions that affect K_{1scc} for steels, Al-alloys and Ti-alloys. This linear variation of K_{1scc} with K_{1c} seem to be independent of alloy YS, E, microstructure and work hardening rate. This observation seems similar in all three systems of alloys.

The question is how much of this behavior is related to chemistry at the crack tip in 3.5%NaCl solution for a given K_{1c} ? Does plasticity ahead at the crack tip affect the reaction rate of the chemistry? What could be a plausible explanation: anodic dissolution under stress or HAC?.