

INTERNAL STRESS AFFECTING ENVIRONMENTAL FATIGUE OF 7075-T651 ALLOY

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Load history has been known to affect fracture and stress corrosion behavior. The degree to which it affects depends on the severity of the load history. It is known that shop peening can retard the SCC lives markedly in steels. Similarly, prestraining can reduce the K_{Isc} and plateau velocity in high strength steels.

These types of experiments are difficult to quantify their effects on the SCC behavior. One can analyze the prestaining effects in a better way by analyzing the effects of single overloads followed by constant applied load to study the behavior. Such experiments can be done by observing the 'incubation time' for a crack to initiate in a fatigue pre-cracked sample, at various constant applied loads in a chemical environment. Such experiments have been conducted on a 7075 aluminum alloy for both static and cyclic loads. It is observed that results are similar in behavior. The data indicates the overall behavior can be analyzed by suggesting that the total stress at the crack tip is related to the contributions from chemistry of the environment and an additional factor from "internal stress" that comes from pre-strain. Hence, we can describe the crack initiation & growth criteria in terms of:

$$K_{Isc} = K_{applied} + K_{internal\ stress} + K_{environment} > K_{threshold}$$

Such trends in the behavior, has been observed in pre-strained steel alloys prior to environmental exposure. The general behavior suggests that the internal stress affects the threshold K_{Isc} more than the plateau velocity. The general SCC behavior is affected by both chemistry and internal stress under external static or cyclic loads.