ASSESSING THE LOADING RATE DEPENDENCE OF HYDROGEN ENVIRONMENT-ASSISTED CRACKING BEHAVIOR IN A WIDE-RANGE OF ENGINEERING ALLOYS

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Though literature indicates that the applied loading rate (dK/dt) can affect hydrogen environment-assisted cracking (HEAC) behavior, quantification of dK/dt dependencies, as well as mechanistic understanding of how the dK/dt influences HEAC, remains limited. In this study, a slow-rising stress intensity (K) testing framework was utilized to measure HEAC kinetics in Monel K-500, Custom 465, AA5456, Ti 6-4, Pyrowear 675, and 316L immersed in various environments at dK/dt ranging from 0.2 to 20 MPa√m/hr. Results for confirm a strong influence of dK/dt on HEAC for material/environment combinations with modest susceptibility. Typically, the crack growth rates (da/dt) exhibiting two characteristic regimes of behavior depending on applied dK/dt. In particular, a ‘plateau’ regime where da/dt is independent of dK/dt was observed for faster dK/dt, while a ‘linear’ regime where da/dt linearly scales with slower dK/dt. Furthermore, the implications of these results on recent testing standardization efforts for environment-assisted cracking are discussed.