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A FAILURE LOCUS FOR HYDROGEN ASSISTED FAILURE

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Abstract. We investigate cracking in the presence of hydrogen by means of a hybrid experimental-numerical approach. Slow strain rate tests are conducted in a Nickel superalloy under different environmental conditions. Finite element analysis of crack initiation and subsequent growth is modeled by means of a hydrogen-dependent traction separation law. A special control algorithm is employed to overcome numerical instabilities intrinsically associated with cohesive zone formulations. The fracture energy is degraded by means of an experimentally-motivated hydrogen degradation relation. Numerical results provide important insight into the failure process, enabling to identify critical values of hydrogen concentration and remote stresses that trigger cracking. The work builds upon previous works by the authors[1,2] and brings important insight into the technologically important problem of hydrogen assisted cracking.

Keywords: Hydrogen embrittlement, Cohesive zone models, Fracture, Finite element analysis.

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