

Numerical modeling of hydrogen-induced brittle fracture

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Hydrogen embrittlement has been a critical issue in the oil and gas industry for decades. Hydrogen from local corrosion processes can enter the lattice of structural steels and severely degrade the fracture properties of the metal, which may lead to unexpected fracture. Now, as hydrogen is poised to become a key element in a sustainable energy infrastructure, the development of predictive tools for hydrogen-induced brittle fracture in steel is more critical than ever before.

Using the novel phase field fracture model, which has seen widespread use in recent years for fracture and multiphysics problems, in conjunction with a hydrogen transport and embrittlement model, we demonstrate a numerical tool with potential for engineering application.

Furthermore we are preparing the development of a new, mechanism-based, model based on novel developments towards discovering the underlying mechanism of hydrogen-induced brittle fracture in high strength steels.