Stress corrosion cracking is an important and complex mode of failure in high-performance structural metals operating in deleterious environments, due to metallurgical, mechanical, and electrochemical factors. Depending on the material/solution system, the stress corrosion cracking mechanism may involve a combination of hydrogen embrittlement (HE) and anodic dissolution. In this article, a numerical model for predicting the mechanical behavior of hydrogen-induced damage in stress corrosion cracking is described. The methodology of modeling used in this study is based on the thermodynamics of continuum solids and elastoplastic damage. This model is based on a stress corrosion mechanism that occurs through the simultaneous interaction of hydrogen and plasticity. This mechanism is also called hydrogen-enhanced localized plasticity, which is a viable mechanism for hydrogen embrittlement. The model is applied to the fatigue damage problems of nuclear reactor pipe, and the results are compared with published fatigue life data obtained experimentally