HYDROGEN INDUCED CRACKING OF ULTRA HIGH STRENGTH 350 GRADE MARAGING STEEL

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This study investigates the hydrogen embrittlement of an ultra high strength 350 maraging steel in peak-aged condition with regard to hydrogen diffusion and trapping/detrapping process of hydrogen. Slow strain rate tensile tests and constant load tensile tests were conducted on notched specimens in a 30g/l NaCl aqueous solution at cathodic potential -1200 mV/SCE. Various conditions of hydrogen ingress were explored in order to study “external” and “internal” hydrogen embrittlement. These conditions refer respectively to a direct cathodic hydrogen charging at the notch tip surface of the specimens, or via a diffusion path in the material by protecting the notch tip from the environment while cathodic charging, or just via a pre-charging of the specimen before mechanical testing.

The results have shown that crack initiation stage is dependent on the hydrogen transport and accumulation by accelerated diffusion along preferential paths. A sub-critical regime of crack propagation was identified. It corresponds to a mixed intergranular/transgranular mode of cracking, the intergranular mode referring to prior austenitic grain boundaries and transgranular mode to high-angle misorientation interfaces of the martensite. This stage is hydrogen diffusion-dependent; it corresponds to a steady state crack growth rate *vs* stress intensity factor. The final fracture at a critical K_{IH} value is dependent on hydrogen content in the material and refers to transgranular mode of cracking.