

**Underground Hydrogen Storage and Hydrogen Transport –
On the Risk of Hydrogen Embrittlement**

Gregor Mori

Abstract

Hydrogen is one possibility to reach CO₂ neutral energy supply for the world. Large quantities of hydrogen have to be stored and transported in the future. Materials for storage and transport are listed in API 5CT for casings and tubings and API 5L for linepipe. In recent years the applicability of these steels with regard to hydrogen embrittlement has been investigated in several projects (Underground Sun Storage, Underground Sun Conversion, HyStorIES, HyGrid², EUH2STARS).

Results show that dry gaseous hydrogen at up to 300 bar for storage and up to 100 bar for transport does not yield sufficient hydrogen uptake to embrittle the steel infrastructure. The main quantity of hydrogen uptake happens by electrochemical corrosion in the presence of dissolved H₂S in Underground Hydrogen Storage (UHS). Conditions in European UHS facilities are not severe enough to initiate hydrogen embrittlement in service. Results are underlined with Constant Load Tests, Slow Strain Rate Tensile Tests, Low Cycle Fatigue Tests and Fracture Mechanics.