Study of the impact of hydrogen gas on the constituent materials of the hyperbaric storage tank

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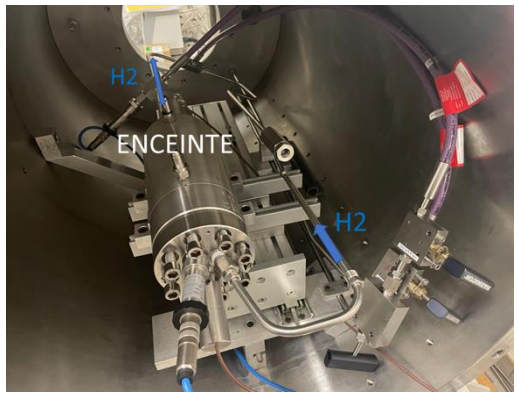
Liner processing
by courtesy of CEA – Le Ripault



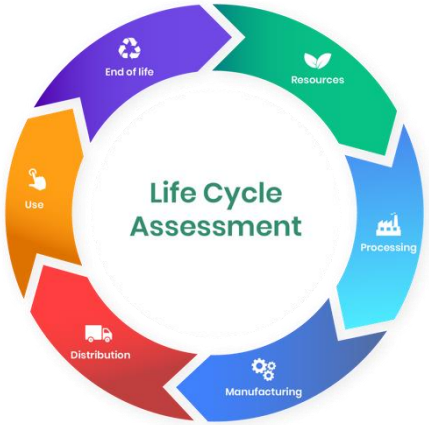
High Pressure H2 Bench for
Rapid Gas Decompression

Context:

HYPERSTOCK project, part of the PEPR - Decarbonized Hydrogen, focusing on environmental impact of storage and distribution of hydrogen under high pressure.

Safety concern: Rapid gas depressurization (RGD) during an emergency tank emptying can cause internal damage to Type IV tank liners, such as micro/nano-cavitation, the criticality of whose effects is not yet fully understood

Environemental concern: Conduct an LCA of a Type IV tank for heavy-duty applications and evaluate the impact of technological evolutions of the liner



Objectives and methods :

Coordinate a series of RGD tests at 900 bar and above under H_2

Comparison of 3 liners materials : PA11, PA6 and HDPE

Cyclic RGD from 900 bar H_2, @ IFPEN

Very High pressure RGD (from 1800 bar under He or H_2) @ Stefan KLOTZ (IMPMC)

Evaluate the impact on functional properties

On mechanical and viscoelastic behaviour : Tensile tests and DMA analyses

On thermodynamic properties: DSC (cristalinity and thermal transitions)

On H_2 barrier function: permeation tests at low and high pressures

Propose detection methods for micro- or nano-cavities

SAXS analysis to reveal damage density

SEM fractographies after cryo-fracture to image nano-cavities

Optic lab-made detection method