

Overview

Hydrogen is regarded as one of the best energy storage options at large scale. However, its storage using conventional high-pressure and cryogenic technologies are expensive. Hydrogen storage via Liquid Organic Hydrogen Carrier (LOHC) systems offers the opportunity for energy storage on a very large scale and over long periods of time without losses. Among the different LOHC compounds that have been considered, pure hydrocarbon systems offer the advantages of low cost and full compatibility with the existing infrastructure for liquid fuels. A particular promising LOHC is the known heat transfer oil, dibenzyltoluene (H0-DBT, Marlotherm SH), that can be catalytically hydrogenated to load up to 6.2 mass % hydrogen (2.05 kWh/kg). Therefore, **HySA Infrastructure** together with Framatome validated and piloted the LOHC technology in South Africa for the first time.

LOHC Facilities

HySA Infrastructure LOHC facilities range from laboratory to pilot scale systems.

RESEARCH / PILOT SCALE SYSTEMS

Small scale LOHC systems are used to test various hydrogenation and dehydrogenation parameters: temperature, resident time, pressure and LOHC durability.



COMMERCIAL PLANT

Pilot scale systems are for field tests and mass production of hydrogenated LOHC.



SPECIFICATIONS	HYDROGENATION PLANT
H ₂ CONSUMPTION RATE	4 Nm ³ /hr
HYDROGENATED LOHC PRODUCTION RATE	5 kg/hr
OPERATING PRESSURE	28 -30 bar
OPERATING TEMPERATURE	140 -180°C
REACTOR VOLUME: APPROX	50 Litres
REACTOR TYPE	Fixed-bed downflow

THE FOLLOWING OBJECTIVES ARE PUT FORWARD:

- Evaluation and demonstration (with partners) of hydrogenation systems for up to 5 Nm³/hr of hydrogen absorption capacity,
- Dehydrogenation catalyst development (with partners), its performance evaluation and characterization.
- Fundamental understanding of the dehydrogenation kinetics of dibenzyltoluene over different heterogeneous catalysts by DFT modelling.
- Validation and demonstration of novel heating concept for LOHC de-hydrogenation and LOHC stability tests upon hydrogenation/de-hydrogenation cycles.
- Benchmark alternative LOHC carrier from various suppliers (with partners).
- Hydrogen purity assessment (for FC applications it has to meet SURFACE VEHICLE STANDARD J2719 specifications).