

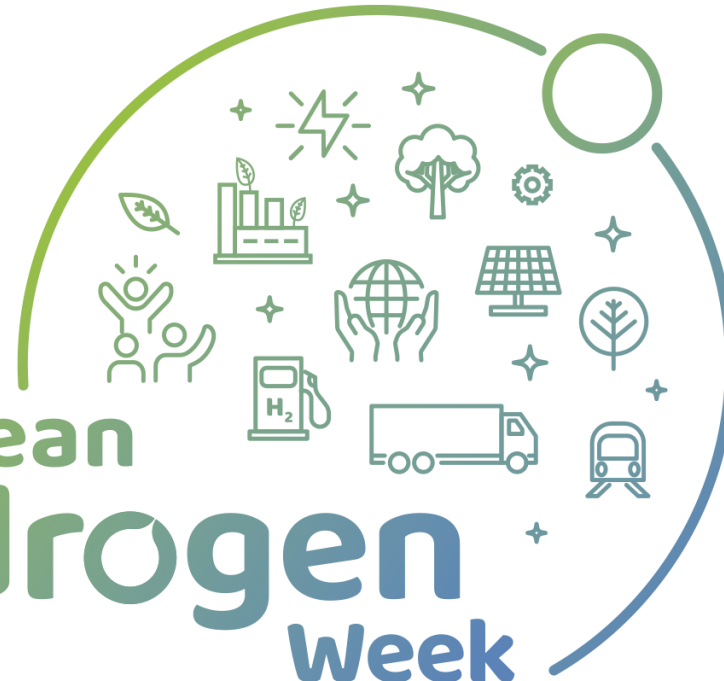
HyCARE

Hydrogen Carrier
for Renewable Energy

Storage



European
Hydrogen
Week



Marcello BARICCO
University of Turin

hycare-project.eu

marcello.baricco@unito.it

#PRD2021
#CleanHydrogen

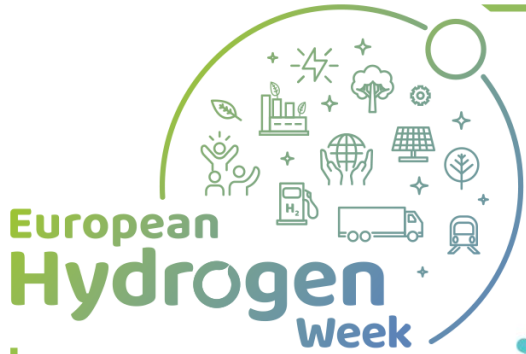




Project Overview

- Call year: 2018
- Call topic: FCH-02-5-2018: Hydrogen carriers for stationary storage of excess renewable energy
- Project dates: 01.01.2019 - 31.12.2022 (12 months extension requested)
- % stage of implementation 01/11/2021: 75 %
- Total project budget: 1 999 230 €
- FCH JU max. contribution: 1 999 230 €
- Other financial contribution: 0 €
- Partners: UNIVERSITA DEGLI STUDI DI TORINO (Italy), ENGIE (France), GKN SINTER METALS ENGINEERING GMBH (Germany), TECNODELTA SRL (Italy), STUEHFF GMBH (Germany), FONDAZIONE BRUNO KESSLER (Italy), HELMHOLTZ-ZENTRUM HEREON GMBH (Germany), CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE CNRS (France), INSTITUTT FOR ENERGITEKNIKK (Norway)

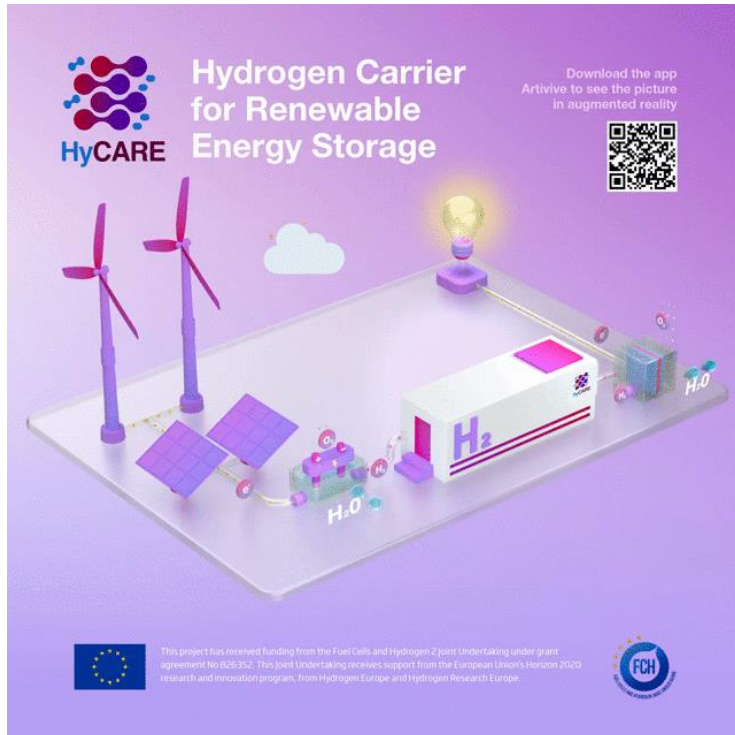




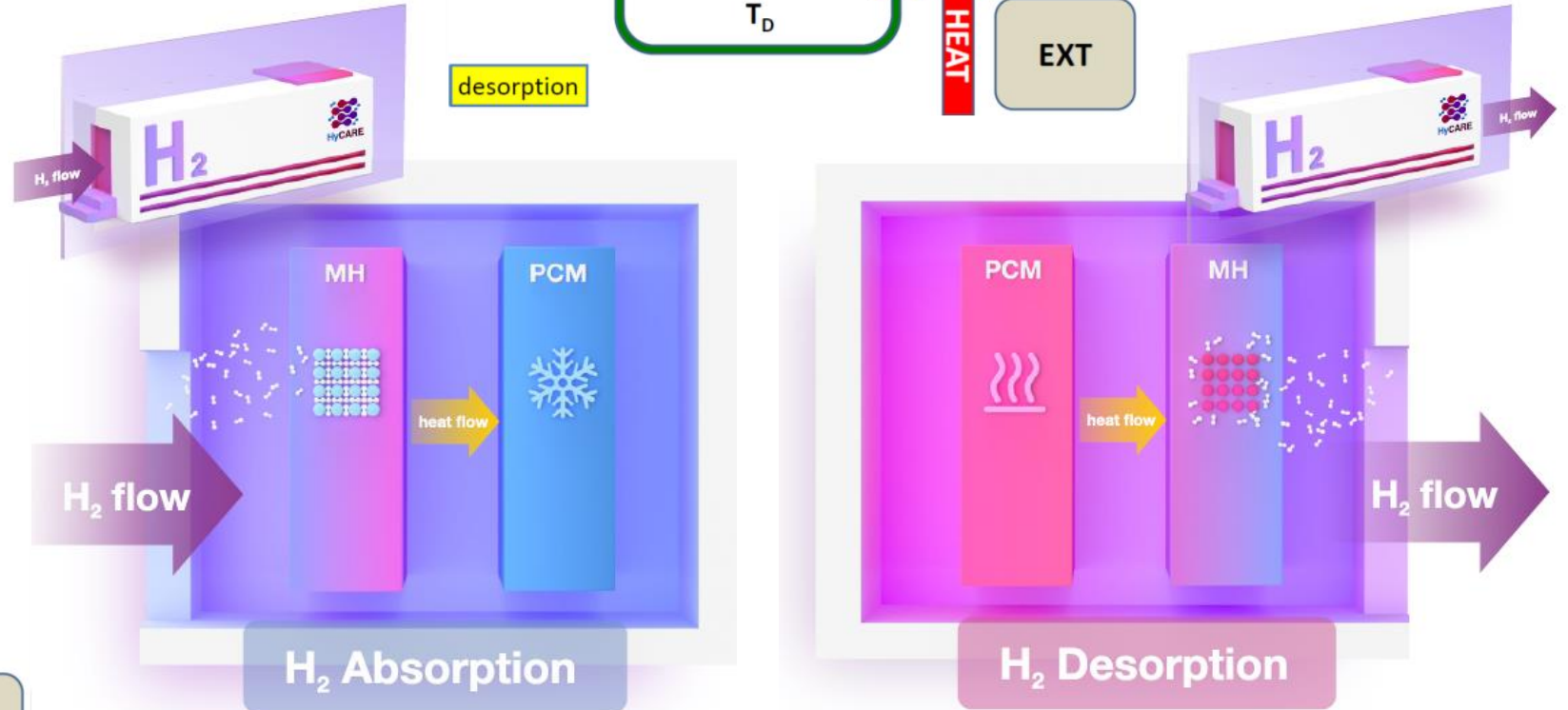
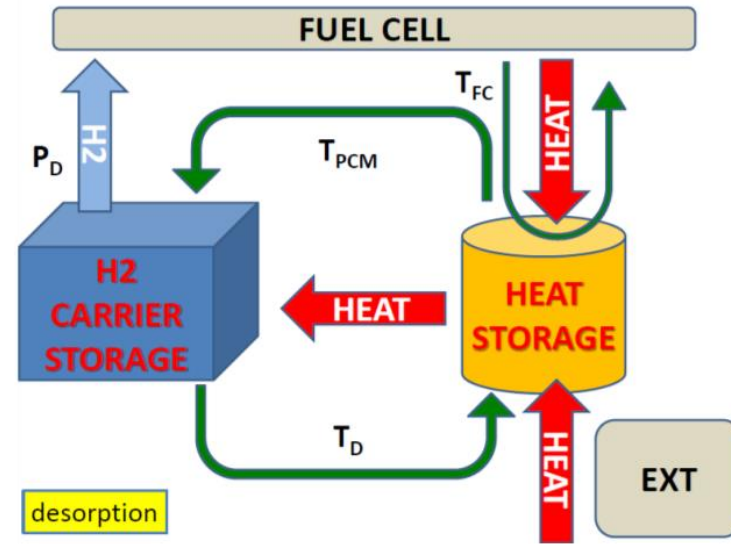
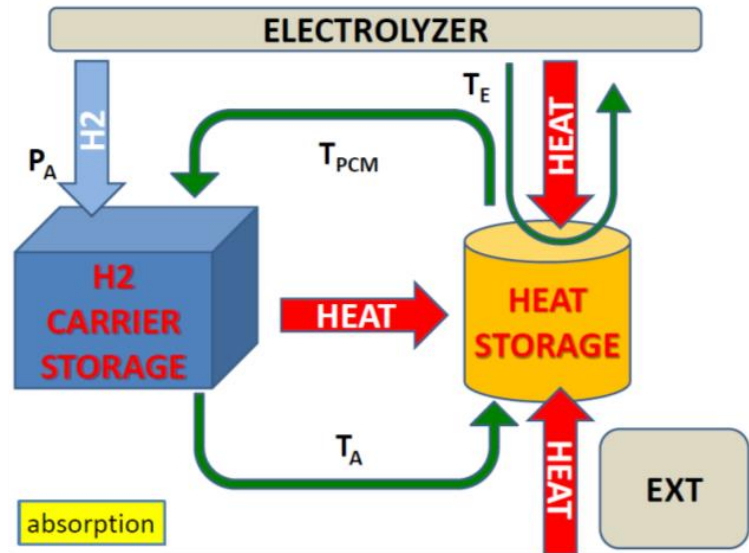
Project Goals



- **High quantity of stored hydrogen** ≥ 50 kg
- **Low pressure** < 50 bar and **low temperature** $< 100^{\circ}\text{C}$
- **Low footprint**, comparable to liquid hydrogen storage
- **Innovative design**
- **Hydrogen storage coupled with thermal energy storage**
- Improved **energy efficiency**
- **Integration** with an **electrolyser** (EL) and a **fuel cell** (FC)
- Demonstration in **real application**
- Improved **safety**
- **Techno-economical evaluation** of the innovative solution
- Analysis of the environmental impact via **Life Cycle Analysis** (LCA)
- Exploitation of **possible industrial applications**
- **Dissemination** of results at various levels
- **Engagement** of local people and institution in the demonstration site



Project Concept





Project Progress/Actions

Temperature and pressure

Achievement to-date

COMMERCIAL
ALLOYS
< 70 °C
< 100 bar

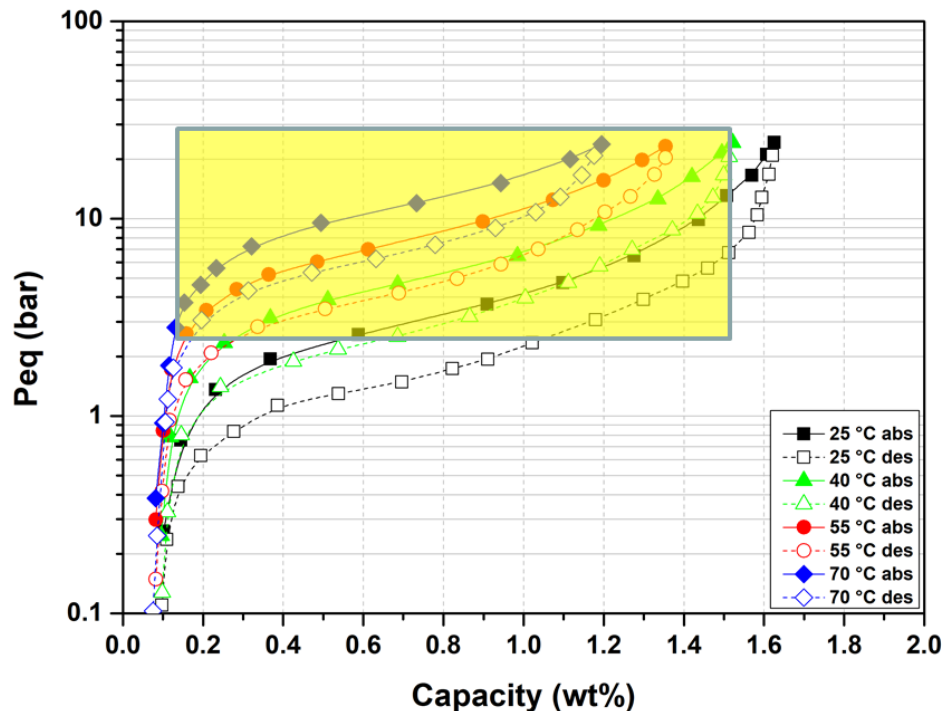


25%

50%

75%

HyCARE
FeTi alloy
55 °C
25-2 bar



Safety

< 30 bar

Low pressure storage

Safety

< 70 °C

Low temperature storage

Project Progress/Actions

Amount of stored hydrogen



Achievement to-date

LAB SCALE
COMMERCIAL
TANKS
< 1 kg



HyCARE
50 kg

25%

50%

75%



PROTOTYPE SYSTEM



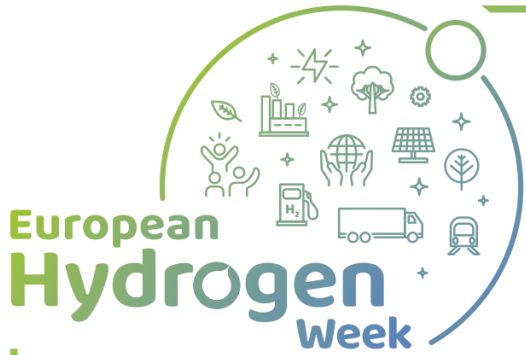
4 TONS
PELLETS
PRODUCTION



Quantity

50 kgH₂

High quantity
of stored hydrogen



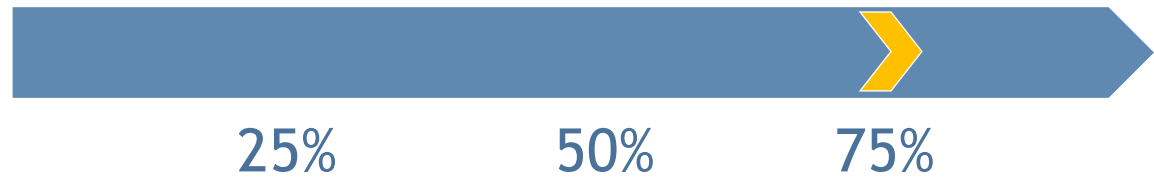
Project Progress/Actions

Energy efficiency

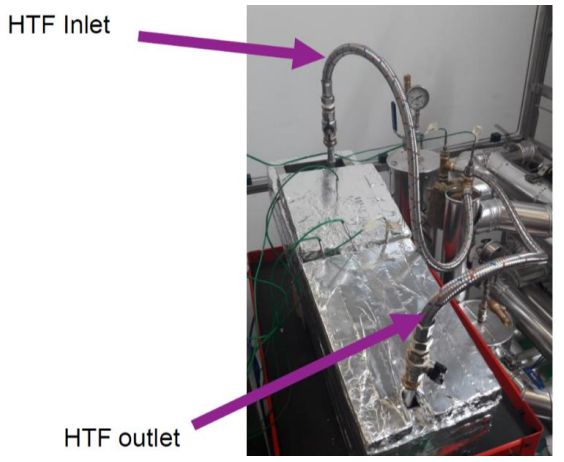
Efficiency
< 70 %
Total round trip
energy efficiency

Achievement to-date

COMMERCIAL
TANKS
NO HEAT
RECOVERY



HyCARE
HEAT
RECOVERY
WITH PCM

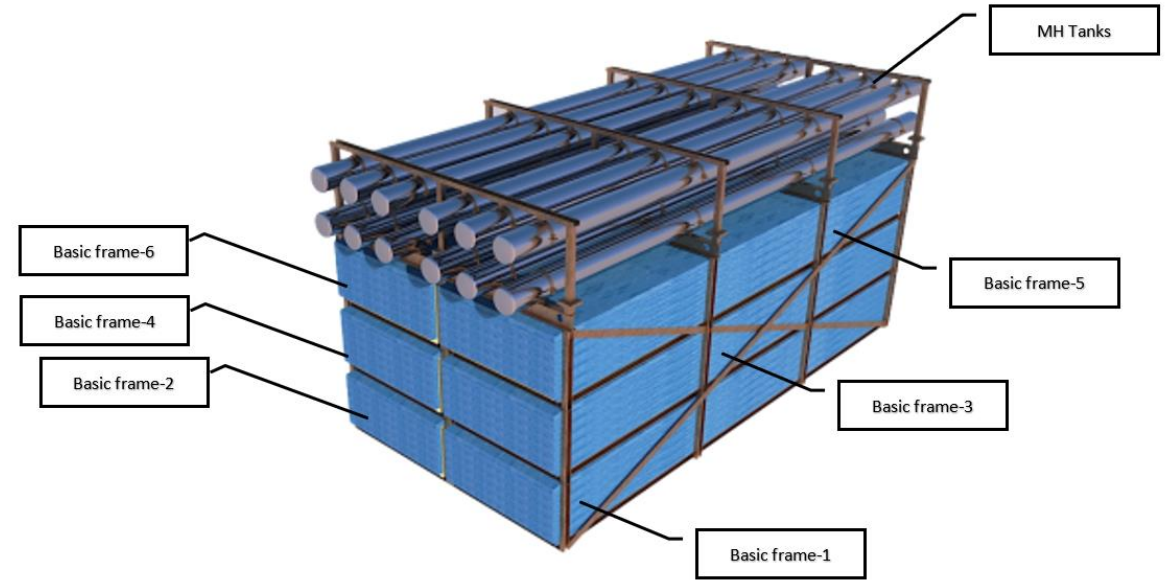


Environmental impact



< 5.0 kWh/kg H₂

External energy source with
innovative design
for large scale storage and use
of non-critical raw materials



#PRD2021
#CleanHydrogen





Project Progress/Actions

Integration



Achievement to-date

NO COMMERCIAL SYSTEMS

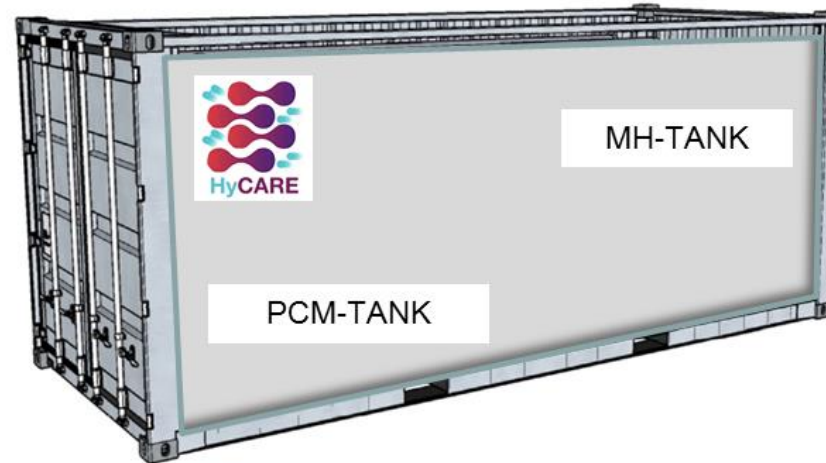


HyCARE INTEGRATED SYSTEM

25%

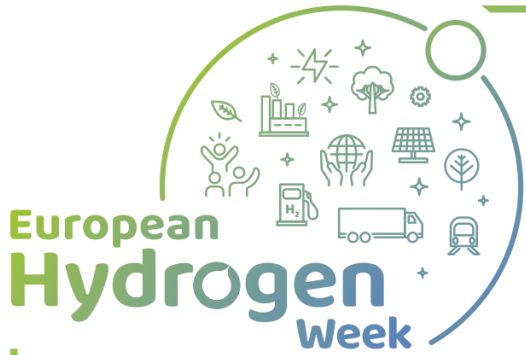
50%

75%



#PRD2021
#CleanHydrogen





Exploitation Plan/Expected Impact

Exploitation



Support Services for Exploitation of Research Results



SERVICE 1 PORTFOLIO DISSEMINATION & EXPLOITATION STRATEGY:	SERVICE 2 BUSINESS PLAN DEVELOPMENT:	SERVICE 3 GO-TO-MARKET SUPPORT:
---	---	------------------------------------

#PRD2021
#CleanHydrogen

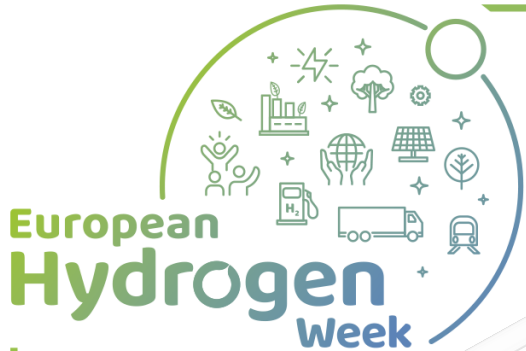


Impact

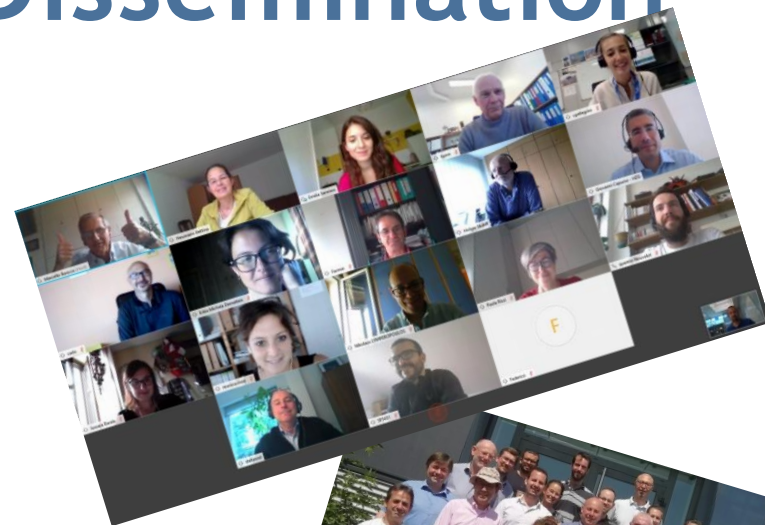
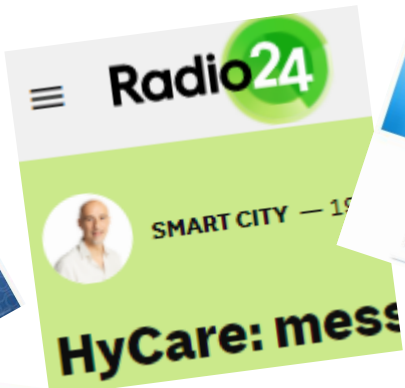


	KPIs	Unit
TECHNICAL	Storage efficiency	$kWh/kg-H_2$
	Gravimetric capacity	$kg-H_2/kg$
	Volumetric capacity	$kg-H_2/m^3$
	Nominal flowrate	kg/h
ECONOMIC	CAPEX	€
	OPEX	€/yr
	Cost of hydrogen (LCoH)	€/kg- H_2
	Lifetime	yrs
	Availability	%





Communications and Dissemination Activities



Second Prize: HyCARE: Hydrogen Carrier for Renewable Energy Storage

11/01/2021

First Poster Competition on Materials Science



Materials Advances REVIEW



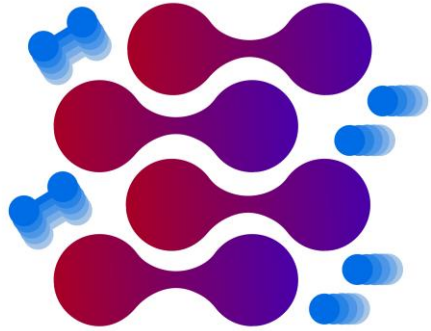
Development of TiFe intermetallics for hydrogen storage in the framework of the European...
Fermin Cuevas, Erika M. Dematteis and Michel Latroche
Institut de Chimie et des Matériaux Paris-Est, CNRS-UPEC, Thiais, France



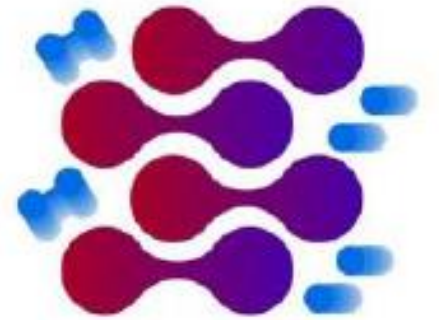
Check for updates
Cite this: Mater. Adv., 2021, 2, 2524

Substitutional effects in TiFe for hydrogen storage: a comprehensive review
Erika M. Dematteis, Nicola Berti, Fermin Cuevas, Michel Latroche and Marcello Baricco

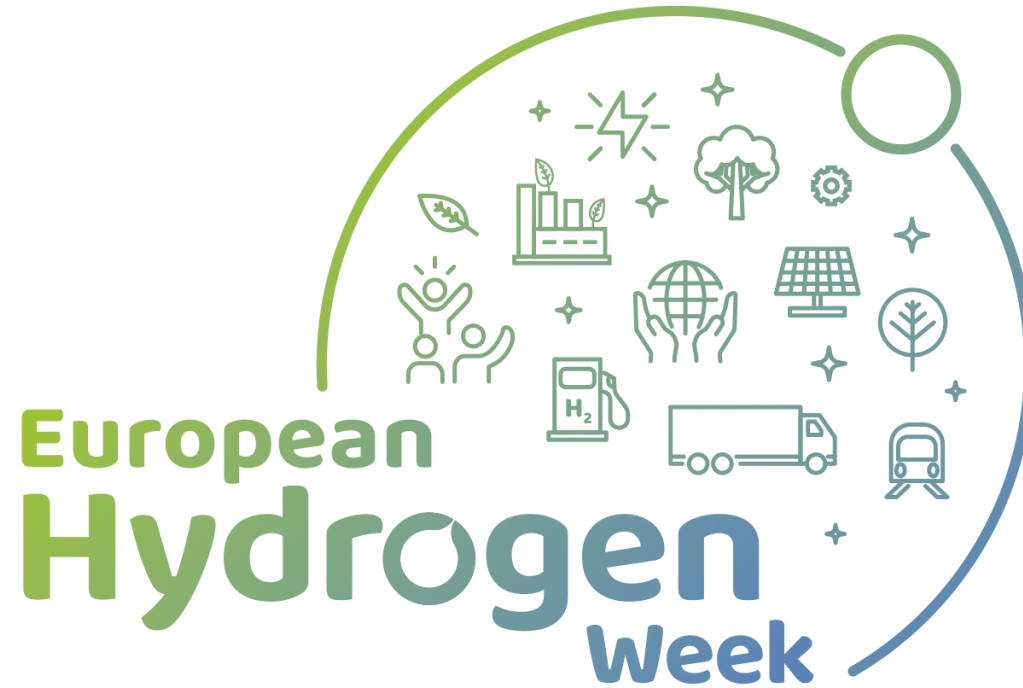




HyCARE



TakeCARE



#PRD2021
#CleanHydrogen

