



# **SSH2S (256653) Fuel Cell Coupled Solid State Hydrogen Storage Tank**

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# SSH2S in figure





**Beginning:**  
**Feb. 1st, 2011**

**End:**  
**Sept. 30th, 2014**

**Duration:**  
**42 months**

**Budget:**  
**3.5 M€ Total**  
**1.6 M€ JU**  
**contribution**

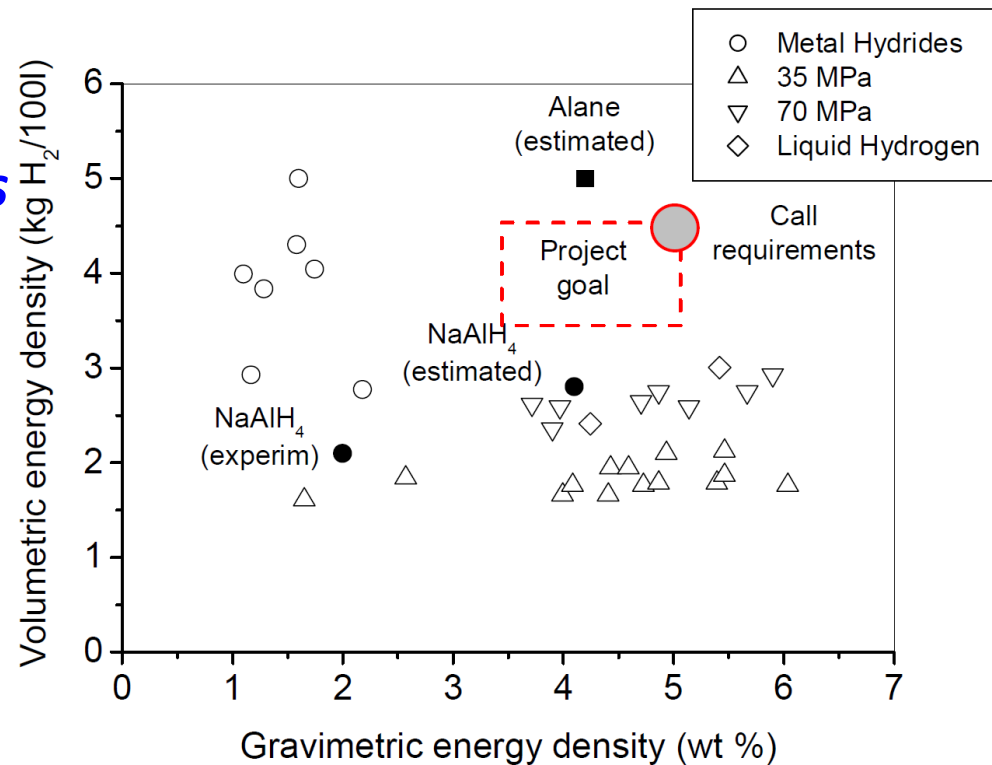
**Partners:**  
**4 research + JRC**  
**3 industries**

Beneficiary Number *	Beneficiary name	Beneficiary short name	Country
1. (Coordinator) 	Università di Torino	UNITO	Italy
2. 	Institute for Energy Technology	IFE	Norway
3. 	Karlsruhe Institute of Technology	KIT	Germany
4. 	Deutsches Zentrum für Luft- und Raumfahrt e.V.	DLR	Germany
5. 	Tecnodelta s.r.l.	TD	Italy
6. 	Serenergy A/S	SER	Denmark
7. 	Centro Ricerche Fiat	CRF	Italy
8. 	Joint Research Centre of European Commission	JRC	Belgium



# SSH2S goals

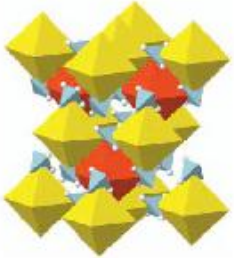
- **Integration** between hydrogen storage system and HT-PEM fuel cell
- Development of **new materials** with high gravimetric and volumetric **energy density**
- **Technically relevant loading temperature and pressure**
- **Loading time and stability of performances after several cycles**
- **New tank** for supply of hydrogen flow.
- **Low cost**



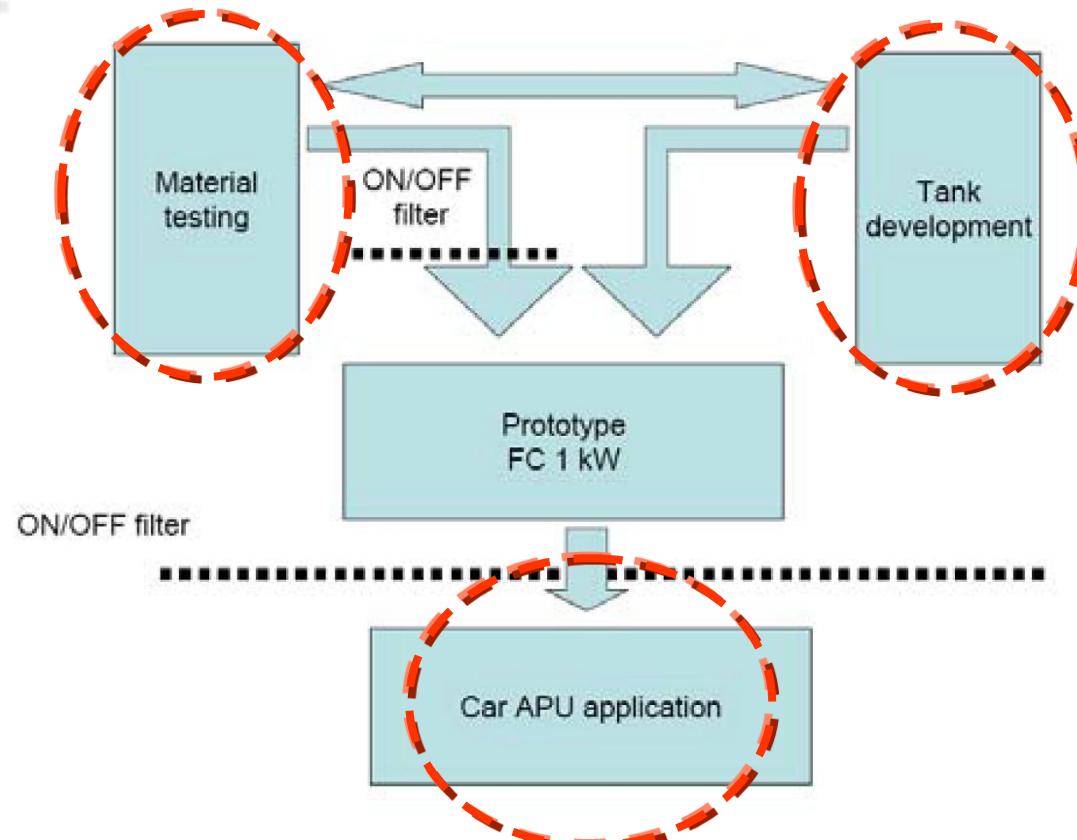
**Volumetric and gravimetric energy density of hydrogen storage systems**



# SSH2S scheme



## INNOVATION



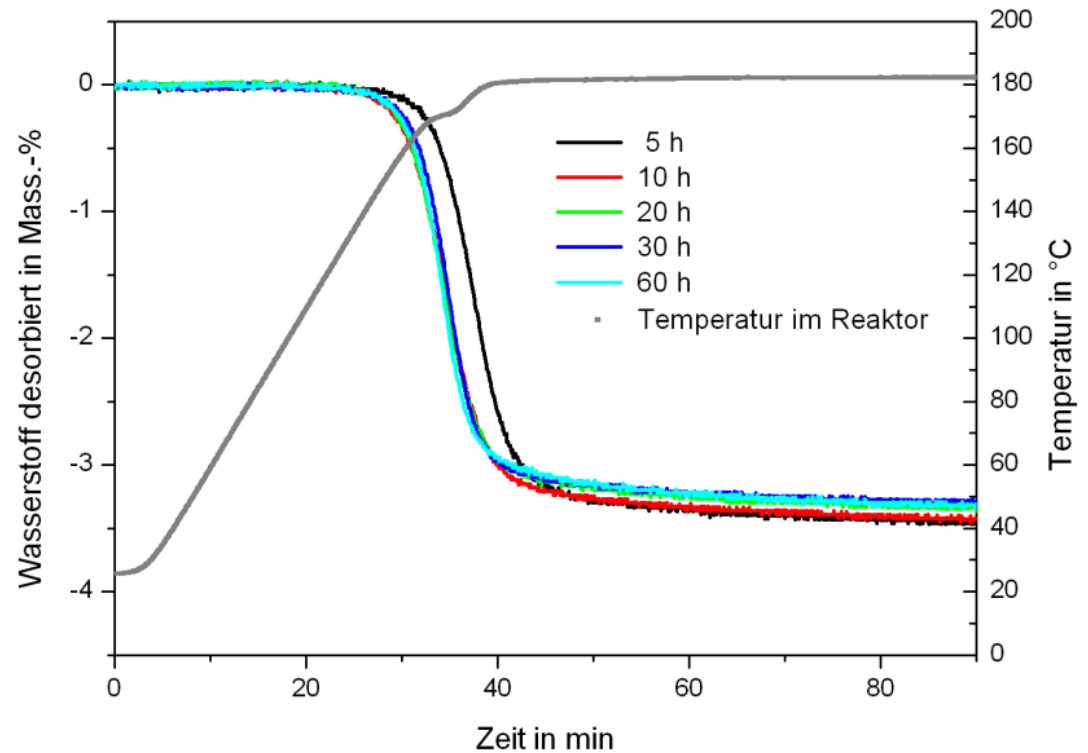
*From new materials to  
integrated system.*

*5 kW<sub>el</sub> APU*



# SSH2S preliminary results

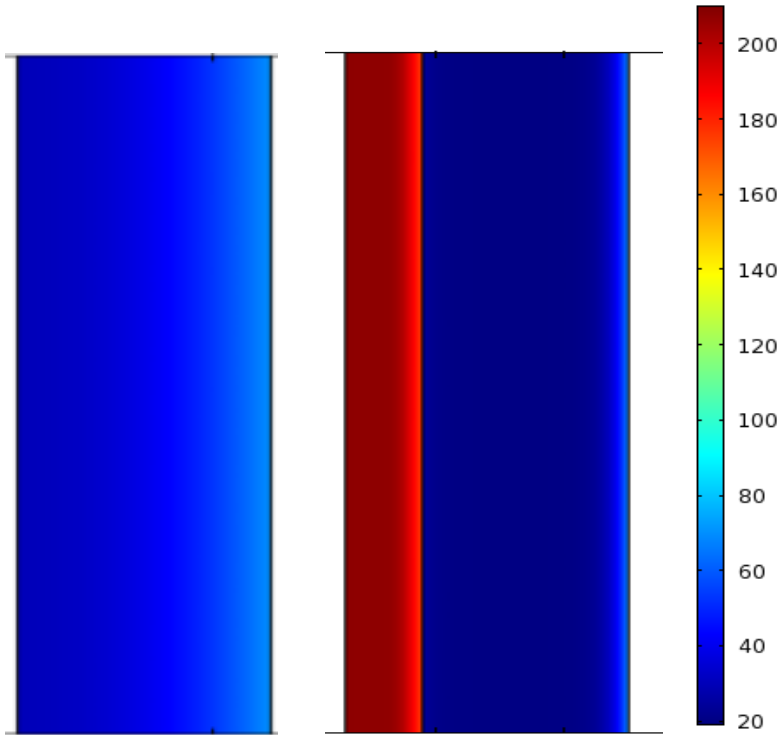
- **System specifications**
- **200 g LiNH<sub>2</sub>-MgH<sub>2</sub> materials production**
- **Ab-initio modeling of new materials**
- **Basic characterization**
- **Simulation of laboratory scale tank**
- **Preliminary design of prototype tank**



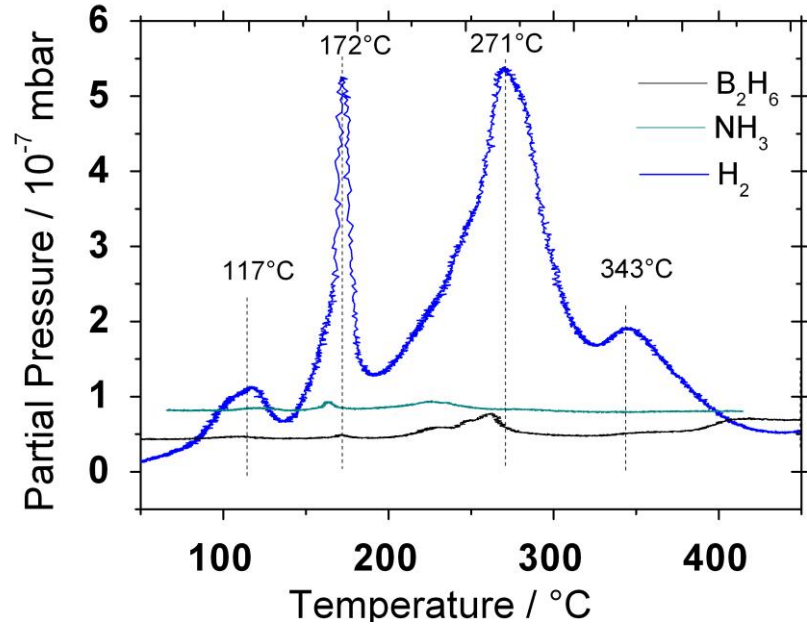
**TGA of LiNH<sub>2</sub>-MgH<sub>2</sub> system prepared by ball milling**



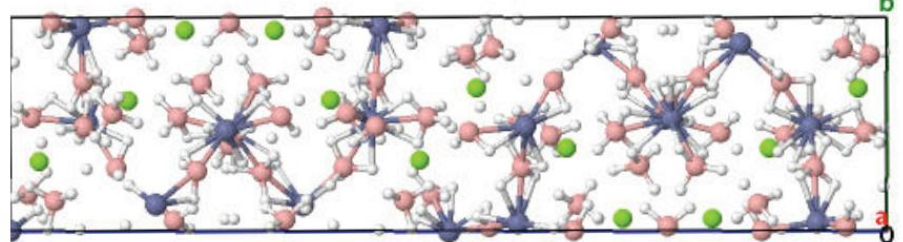
# SSH2S preliminary results



**Tank simulation**



**TPD of LiNH<sub>2</sub>-MgH<sub>2</sub> system**



**Ab-initio modelling of mixed borohydride**



# SSH2S vs MAIP/AIP

AA 2: Hydrogen Production, Storage & Distribution

## **MAIP/AIP targets:**

- **Long-term and break-through oriented research on improved solid state hydrogen storage options for increased efficiency and storage capability, i.e. 2nd generation hydrogen storage technology.**
- **Improved system density for H2 storage (2015: 9 %wt of H2)**
- **Storage materials with capacities  $\geq 6$  wt.%,  $\geq 60$  kg H2/m3 reversibly releasing hydrogen at operating temperatures compatible e.g. with PEM FC, HT PEM FC or SOFC / MCFC**
- **Cost effective production routes of the materials**



HT-PEM from Serenergy



# SSH2S vs MAIP/AIP

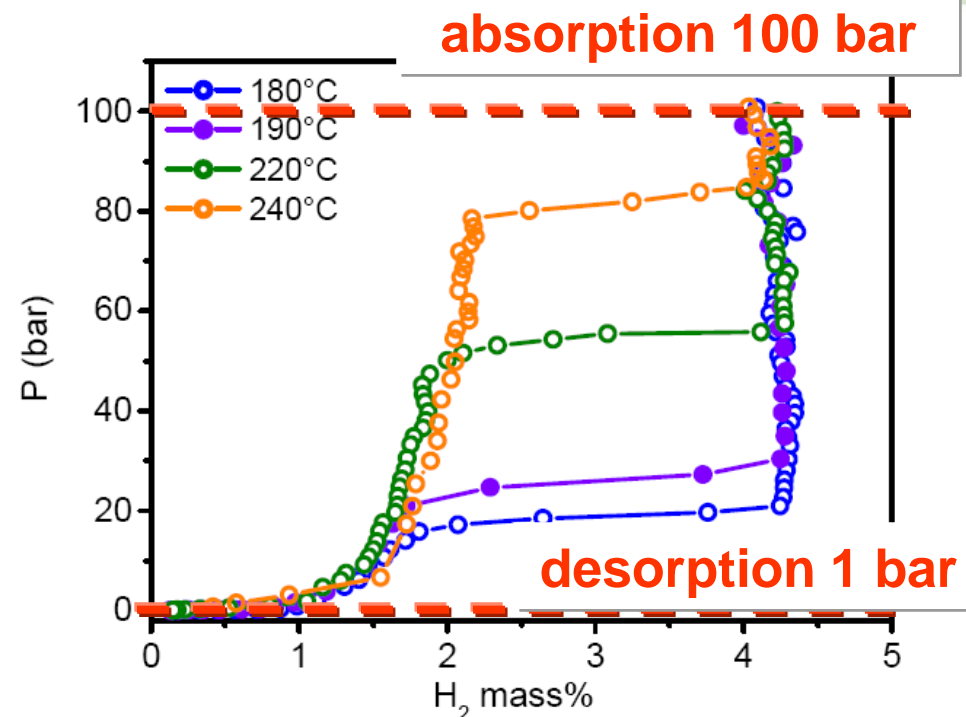
AA 2: Hydrogen Production, Storage & Distribution

**Project activities/results versus MAIP/AIP targets:**

- Storage materials with capacities **up to 4.5 wt%**
- Reversibility at **180 ° C**
- **Single** reaction step
- **Stability** on cycling

**Gaps/bottlenecks in RTD proposed by MAIP/AIP:**

- Development of **new materials** with high gravimetric density
- **Cost** of new materials



*PCI measurement of hydrogen storage material*





# SSH2S cross cutting issues

- **Training: 2 PhD student and 4 PostDocs** involved in the projec
- **Safety** assessment for the integrated system
- **Dissemination & public awareness** planned: papers, conferences, workshops
- **Website [www.ssh2s.eu](http://www.ssh2s.eu)**
- **Hydrogen technologies application to common life**





# SSH2S cooperations

- **Connections with other *EU-FP7* projects on solid state hydrogen storage (*FLYHY, NANOHY, H2FC*)**
- **Connections with Working Group “Solid State Hydrogen Storage” inside *N.ERGHY***
- **Connections with *NEW-IG***
- **Connections with *national and international hydrogen organisations***
- **Technological transfer to *SME***



***Gas purification plant from Tecnodelta***



# SSH2S acknowledgments

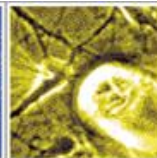
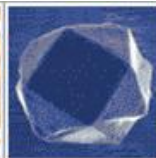
*Thank you for your attention*



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