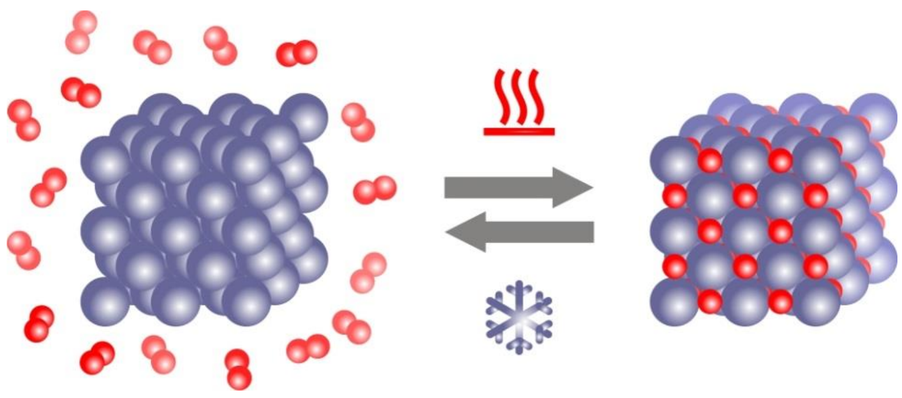
Metal Hydride Hydrogen Compressors

A modularly scalable, intrinsically silent and low cost hydrogen compression system

Emmanuel Stamatakis[1,2], Zoe Massina[1,2], Christos Agrafiotis[1,3] & Dimitris Hatzipetrou[2,4]

[1]DIADIKASIA Business Consultants S.A., Halandri, Greece
[2]National Centre for Scientific Research Demokritos, 15310 Agia Paraskevi, Attica, Greece
[3]DEUTSCHES ZENTRUM FUER LUFT - UND RAUMFAHRT EV (DLR), Germany
[4]HYSTORE Technologies Ltd., Nicosia, Cyprus

In general, a Metal Hydride Hydrogen compressor is a compressor that works by absorbing hydrogen at low pressure and temperature and desorbing it at a higher pressure by raising the temperature with an external heat source like a heated water bath. Metal hydrides are special alloys that can chemically store hydrogen in their metallic lattice.



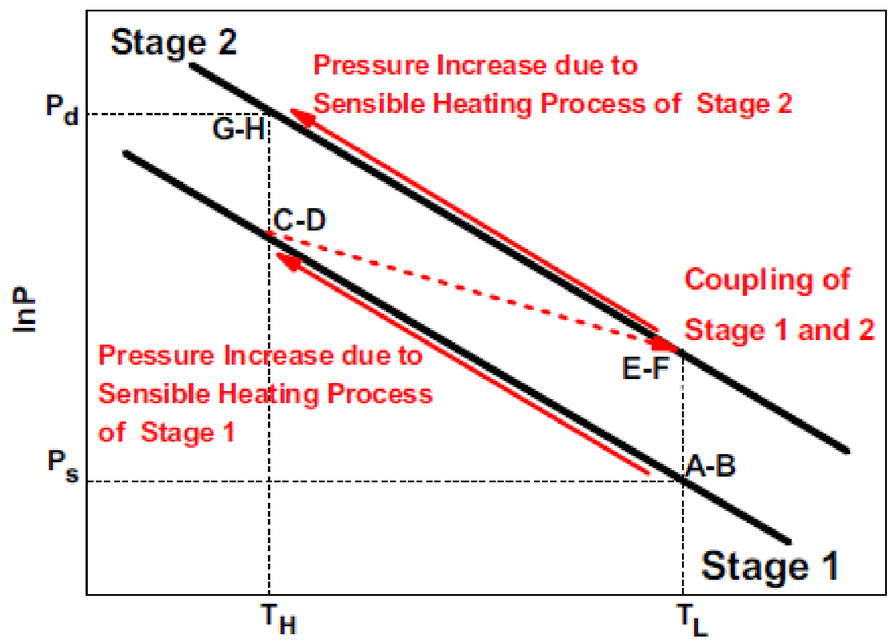
This operating principle called thermal hydrogen compression system – based on the equilibrium pressure as a function of temperature and hydrogen content of the hydride – can offer an innovative economic alternative to traditional mechanical hydrogen compressors apart from the technical application for hydrogen storage in solid material.

Advantages

Non-mechanical hydrogen compressors have several advantages over the mechanical ones, including:

- ✓ **smaller size**
- ✓ **lower noise levels**
- ✓ **lower operating and maintenance costs**
- ✓ **Increased efficiency (especially when using available heat wastes or excess renewable energy to feed the chemical compressor)**
- ✓ **Flexibility over a wide range of compression**

Moreover, since the hydrogen absorption-desorption plateau pressure of a metal hydride (MH) varies with temperature according to the van't Hoff equation ($\ln P = \Delta H/RT - \Delta S/R$), the MH compressors are thermally powered systems that use the ability of reversible metal hydrides to compress hydrogen **without any contamination**.

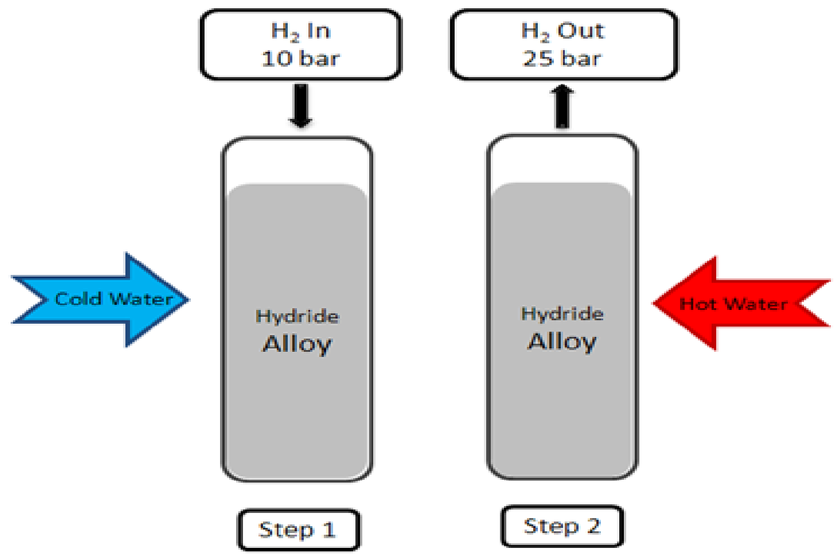


A van't Hoff plot illustrating the operation of a two-stage Metal Hydride Hydrogen Compression

Identification of Target Markets and other Market Issues

Based on these clear advantages, two major niche markets have been identified:

1. **RES & H2 autonomous power systems of islands**
   and
2. **Hydrogen filling stations for vehicles.**



Metal hydrides basic principle

✓ Very good commercialization potential for MH2C

✓ Both major target markets identified (i.e. Large – scale Hydrogen Production using excess energy from RES and H2 vehicle refueling stations), show a rapid development.

✓ The cost of hydrogen compressors does not have a significant impact on the technoeconomic analysis of large-scale RES – Hydrogen power systems

✓ A cost reduction in the order of 15-20% to the currently existing cost of the thermal compressor would play a significant role in the commercialization of the product in small scale applications, such autonomous, self sufficient residences

This work is supported by the **ATLAS-MHC European Project PIAP-GA-2013-612292**
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