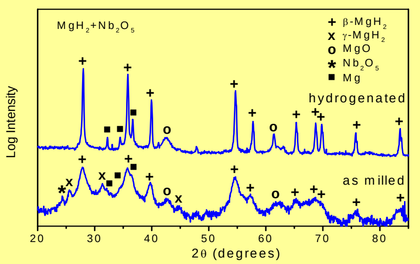
Study of Mg-based materials to be used in a functional solid state hydrogen reservoir for vehicular applications

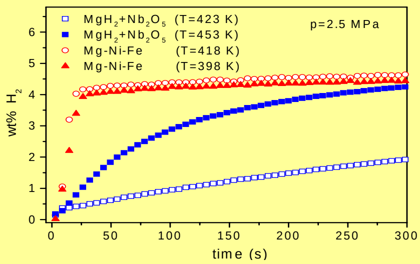
G. Principi[a], A. Maddalena[a], M. Petris[a], P. Palade[a], S. Sartori[a], E. Settimo[b], B. Molinas[c], S. Lo Russo[d]
[a]Settore Materiali, Dipartimento di Ingegneria Meccanica, Università di Padova, via Marzolo 9, 35131 Padova
[b]Celco-Profil, via dell'Artigianato 4, 30030 Vigonovo (Venezia)
[c]Venezia Tecnologie, via delle Industrie 39, 30175 Marghera (Venezia)
[d]Dipartimento di Fisica, Università di Padova, via Marzolo 8, 35131 Padova
local contact: giovanni.principi@unipd.it

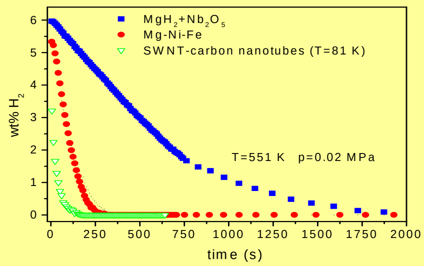
Powder mixtures of nanosized MgH_2 and suitable additives have been obtained by high energy milling. Their use has been considered for a prototype of an innovative functional solid state hydrogen reservoir.

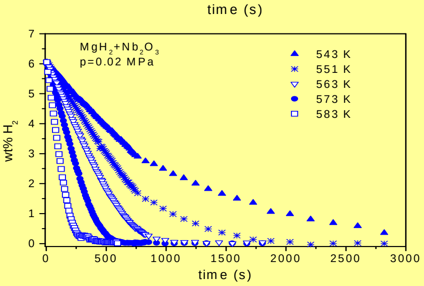
A prototype of a two stages reservoir is under development (patent pending). The hydrogen release from the main stage, with our high capacity Mg-based hydrides, is primed by an auxiliary stage containing commercial hydrides able to operate at room temperature.

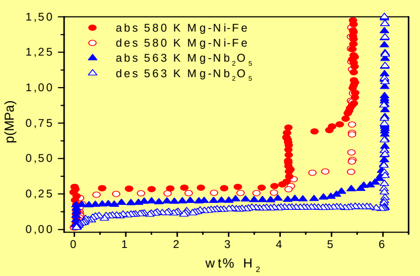
MATERIALS CHARACTERISATIONS (XRD, hydrogen absorption/desorption, pressure composition isotherms)











ENERGETIC BALANCE (approximate)

<u>For 100 g of MgH_2 milled with additives</u>

- Hydrogen content = 6 g
- Energy delivered by 6 g of hydrogen = 720 kJ
- Energy necessary to heat the powders = 40 kJ
- Energy necessary for hydride dissociation = 228 kJ
- Energy of available hydrogen to feed the fuel cell = 452 kJ
- <u>Net energy to the electric engine = 226 kJ</u> (fuell cell efficiency of 50 %)
- **<u>The net hydrogen capacity of our reservoir is therefore about 3.8 wt %</u>** (as a consequence, 1.6 kg of doped MgH_2 plus 0.5 kg of commercial AB_5 hydride are sufficient to feed a fuel cell driving for 1 h an electrical engine of 1 kW)

DESIGN OF THE RESERVOIR (schematic)