

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

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Powder mixtures of nanosized MgH₂ 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 a primer stage containing commercial hydrides able to operate at room temperature.

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

ENERGETIC BALANCE (approximate)

DESIGN OF THE RESERVOIR (schematic)

For 100 g of MgH₂ milled with additives

- 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
- Net energy to the electric engine = 226 kJ (fuel cell efficiency of 50%)
- The net hydrogen capacity of our reservoir is therefore about 3.8 wt % (as a consequence, 1.6 kg of doped MgH₂ plus 0.5 kg of commercial AB₅ hydride are sufficient to feed a fuel cell driving for 1 h an electrical engine of 1 kW)

