



Li amide mixed with Mg hydride: a promising system for solid state hydrogen storage

S. Barison^a, F. Agresti^a, S. Lo Russo^b, A. Bianchini^b,
A. Maddalena^a, P. Palade^{a*}, G. Principi^a, G. Torzo^b

^aSettore Materiali, Dipartimento di Ingegneria Meccanica,
Università di Padova, via Marzolo 9, 35131 Padova, Italy

^bDipartimento di Fisica, Università di Padova,
via Marzolo 8, 35131 Padova, Italy

*National Institute for Physics of Materials, Atomistilor 105 bis,
P.O. box MG-7, 077125 Bucharest-Magurele, Romania

local contact: giovanni.principi@unipd.it

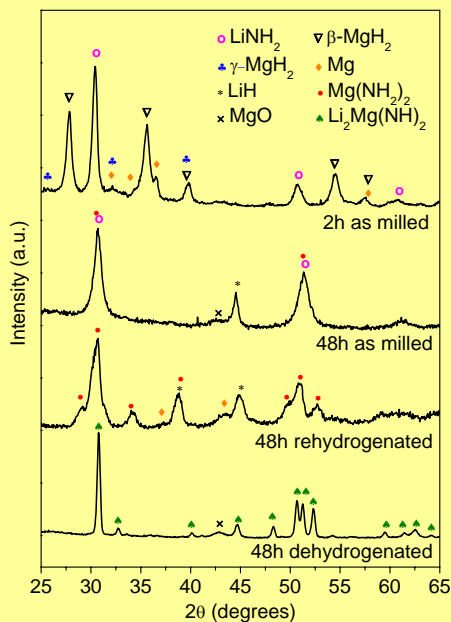
aim

to study the influence of high energy milling time on the hydrogen
A/D kinetics of a mixture of Li-amide and Mg hydride in the
temperature range 220÷240 °C

milling with SPEX 8000M

BPR 10:1

2, 12, 24, 48 h argon atmosphere



XRD
patterns
display the
effect on the
crystalline
structure of

- milling
- activation
- hydrogen
A/D
processes

activation reaction

(18-20 h at 220-230 °C)



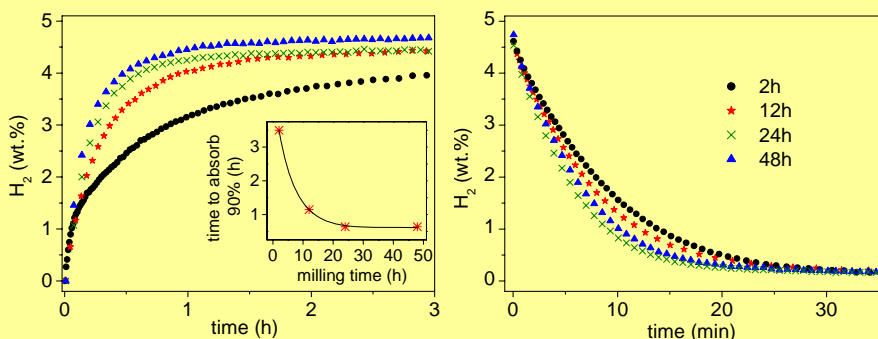
reversible reaction



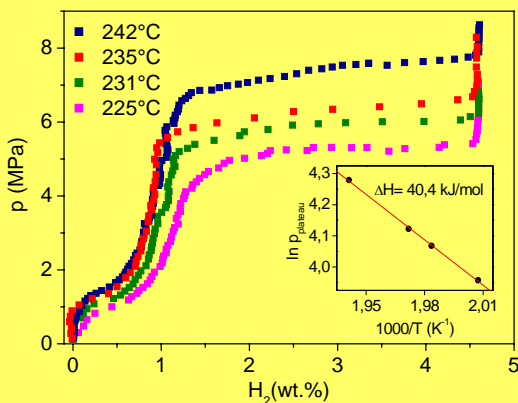
Rietveld analysis of XRD patterns

sample	as milled		rehydrogenated	
	phases	crystallite size (nm)	phases	crystallite size (nm)
milled 2h	LiNH ₂ tetragonal	31 ± 4	Mg(NH ₂) ₂ tetragonal	38 ± 4
	β-MgH ₂ tetragonal	22 ± 3	LiH cubic	130 ± 10
	γ-MgH ₂ orthorombic	15 ± 4	MgO cubic	/
	Mg hexagonal	/		
milled 12h	LiNH ₂ tetragonal	18 ± 3	Mg(NH ₂) ₂ tetragonal	30 ± 5
	β-MgH ₂ tetragonal	13 ± 2	LiH cubic	110 ± 15
	γ-MgH ₂ orthorombic	23 ± 5	MgO cubic	/
	Mg hexagonal	/		
	MgO cubic	/		
milled 24h	LiH cubic	70 ± 15	Mg(NH ₂) ₂ tetragonal	16 ± 2
	LiNH ₂ tetragonal	17 ± 3	LiH cubic	110 ± 10
	Mg(NH ₂) ₂ tetragonal	20 ± 7	MgO cubic	/
	MgO cubic	/		
milled 48h	LiH cubic	80 ± 20	Mg(NH ₂) ₂ tetragonal	15 ± 2
	LiNH ₂ tetragonal	15 ± 3	LiH cubic	60 ± 7
	Mg(NH ₂) ₂ tetragonal	15 ± 6	MgO cubic	/
	MgO cubic	/		

A prolonged milling time is effective in improving the A/D kinetics, irrespective of the presence or not of any kind of tested additive



The enthalpy of decomposition reaction results to be about 40.4 kJ/mol, as derived from the van't Hoff plot using the values of the plateau pressures measured in desorption mode



CONCLUSIONS
 prolonged milling
 of Li-amide plus
 Mg-hydride
 leads to:

- reduced crystallite size
- better dispersion
- more efficient activation
- better A/D kinetics
- higher H₂ capacity