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project MGH_2

85 x more storage capacity

for Hydrogen based on

special processed

“Nano Structured Magnesium Hydride”

- method 1 of H storage

compressed

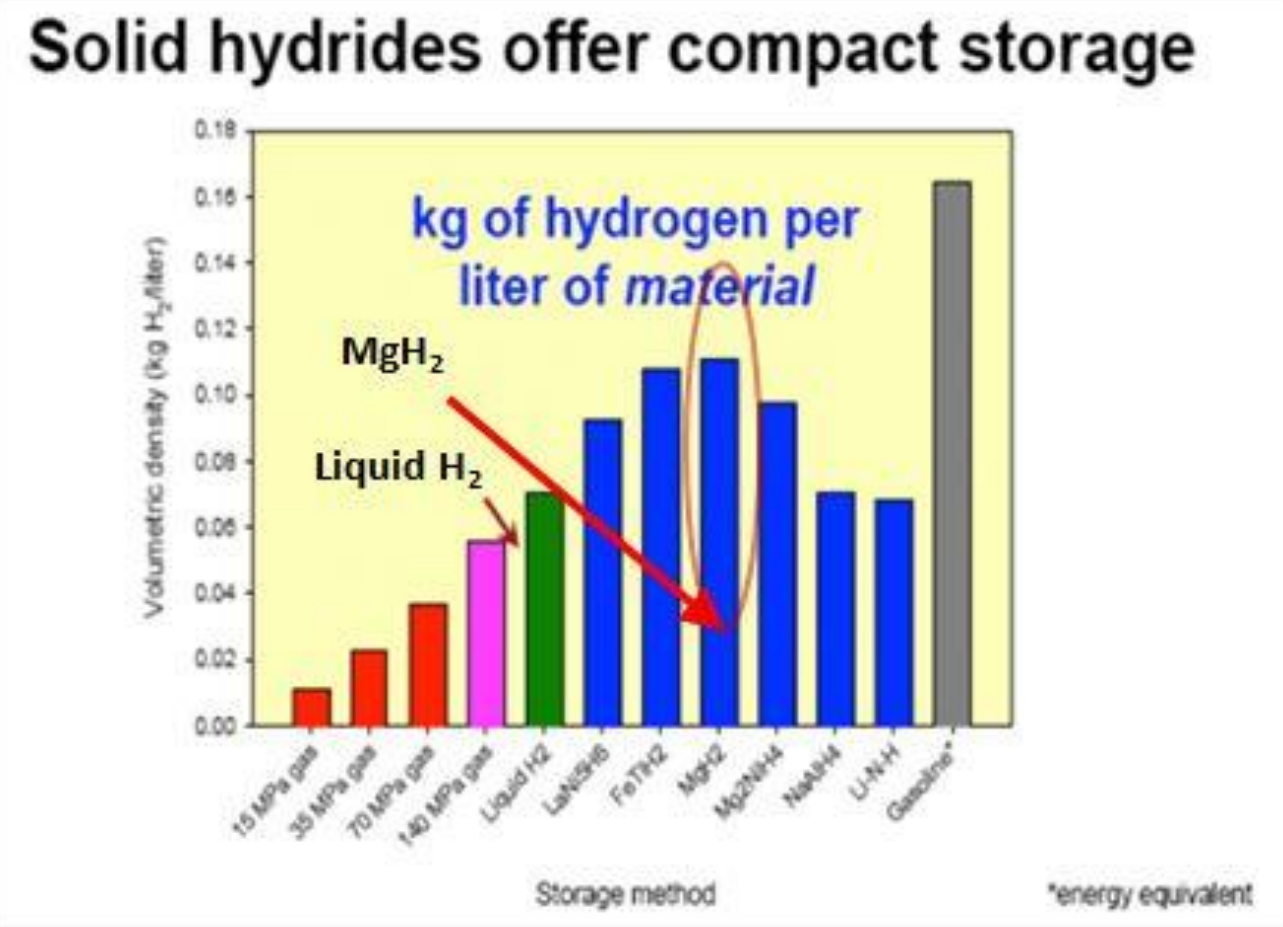
at pressures up to **700** bars in steel or composite gas cylinders

+ approved and established
+ simple technique (at first view)
- explosion hazard
- low energy density
- cost- and energy-intensive (up to 30% of the energy stored)
- pressure reduction needed (700 bar down to 1 bar)
- no infrastructure for mobile applications available

magnesium hydroxide - MgH_2

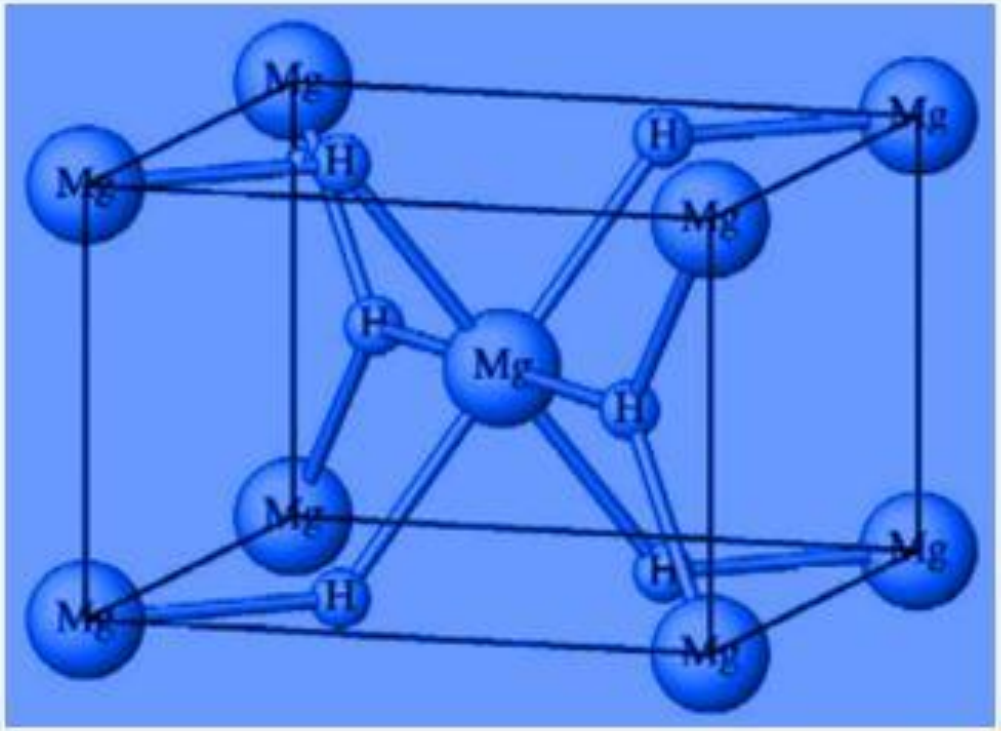
WHY MgH_2 ?

- the highest hydrogen storage capacity of 7.6 wt. %
- huge deposits of Mg (2.5% of the earth's crust)
- cheap raw material (about 2.50 € / kg)
- light-weight (1.738 g/cm3)
- reversible process
- very high H2 storage stability
- a very high level of safety



- method 4 of H storage

in MgH_2 alloy



Hydrogen + metal $\Longleftrightarrow$ to process MgH_2

- high volumetric storage density
- high level of safety
- high degree of freedom in tank design
- simple technique (p=const. ≈ normal pressure)

up to 85 x more storage capacity in same volume under same pressure conditions

advantages of MgH_2

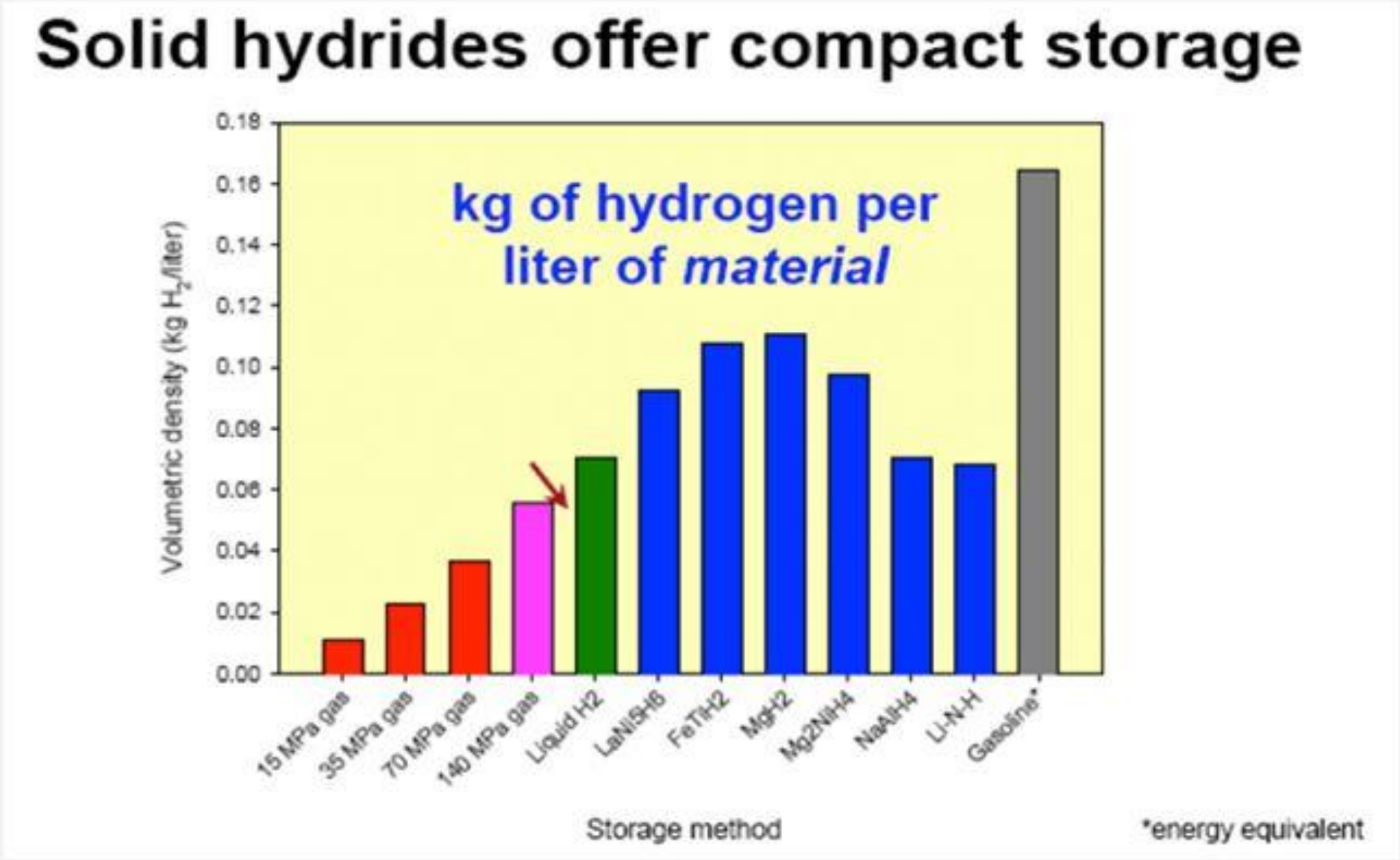
Fast charging / discharging kinetics owing to

- diffusion along grain boundaries
- high density of structural defects (e.g. dislocations, vacancies)

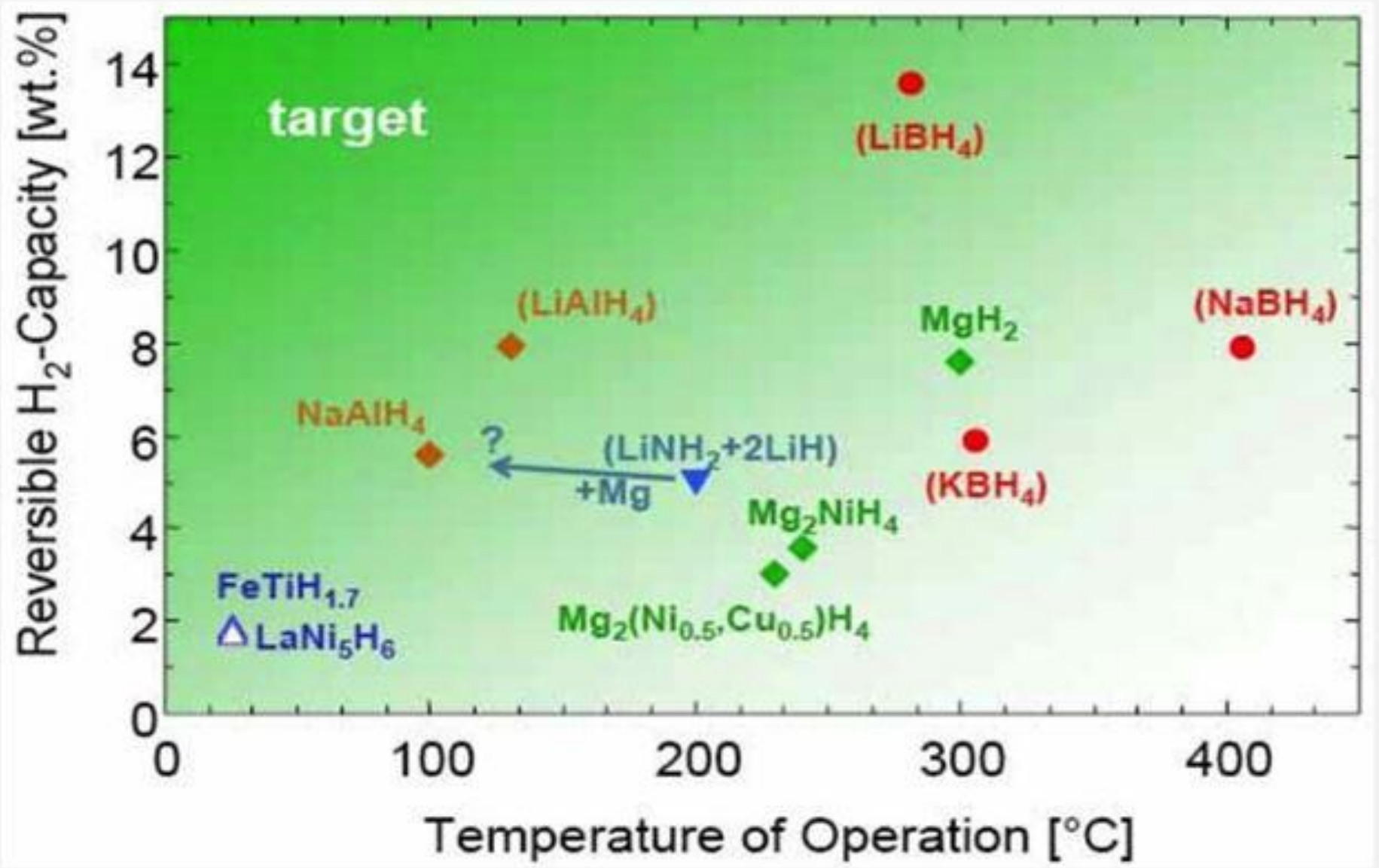
our technique

- is suitable for industrial use and up-scaling to mass production
- is energy and time saving
- enables direct production of bulk nano-structured Mg by avoiding handling of dangerous Mg powders
- free from contamination

- volumetric storage capacity

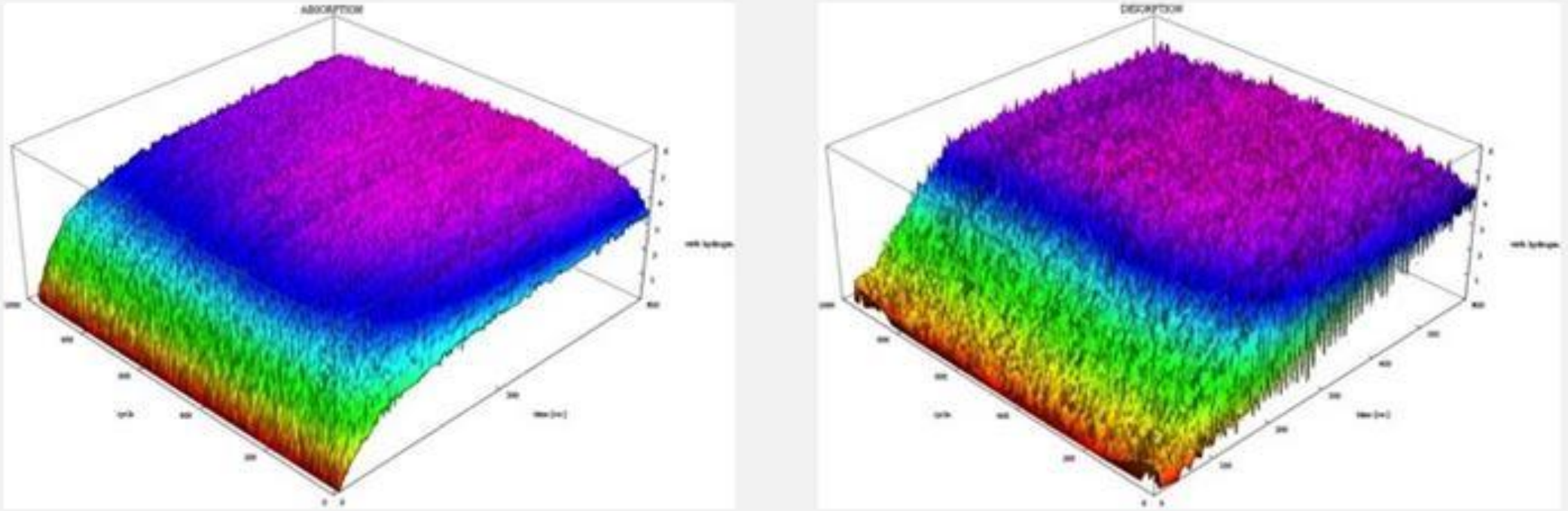


- gravimetric storage capacity vs. operation temperature



durability – cyclic performance

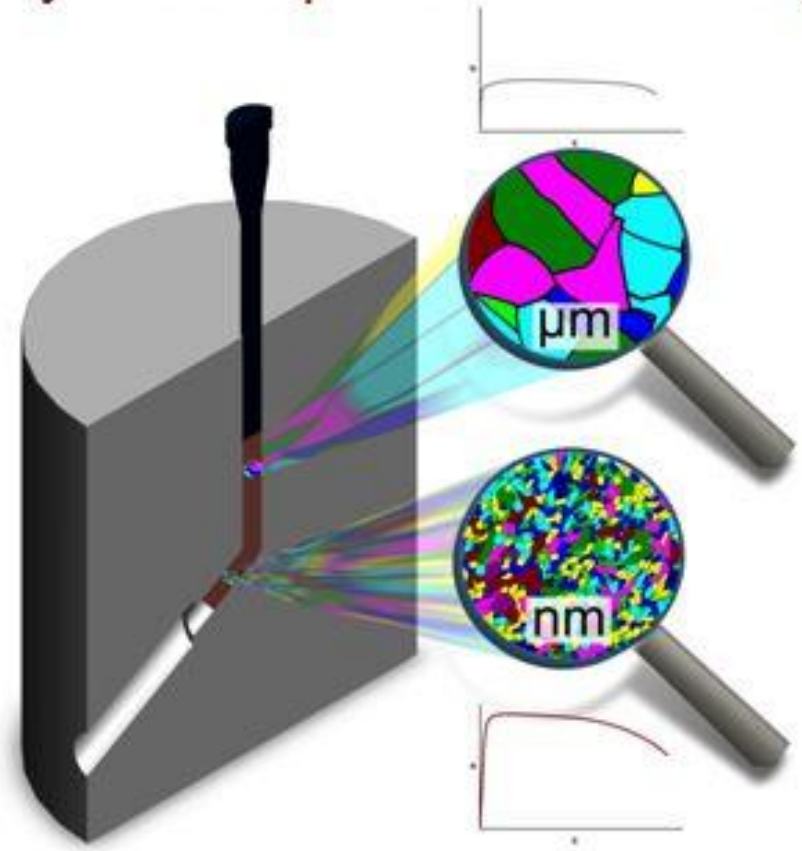
These superior properties of our processed MgH_2 do not degrade even after 1000+ charging and discharging cycles



Charging (left) and discharging curves (right) of processed MgH_2 vs. time and number of cycles

Equal Channel Angular Pressing (ECAP) – the principle

- The metallic material is pressed through a die consisting of two equal channels intersecting at a set angle.
- It undergoes a very high plastic deformation by simple shear under enhanced hydrostatic pressure without any change in the cross-sectional dimensions.



Schematic diagram of the ECAP process

- Thus the ingot can be pressed repetitively through the same die as well as rotated between consecutive passes (routes) to activate different slip systems and to attain extremely large, multidimensional strain
- These facts leads to a microstructural refinement down to ultrafine grained (UFG) microstructure and consequently to altered (mechanical) properties i.e. high strength at still decent ductility as well as enhanced fatigue limits.

Thanks for watching

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