Supporting information

Solid state synthesis of nano-sized AlH_3 and its de-hydriding behaviour

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Figure S1. Proposed reagent of the LiH, CaH_2, MgH_2 and $AlCl_3$ phase as identified by XRD

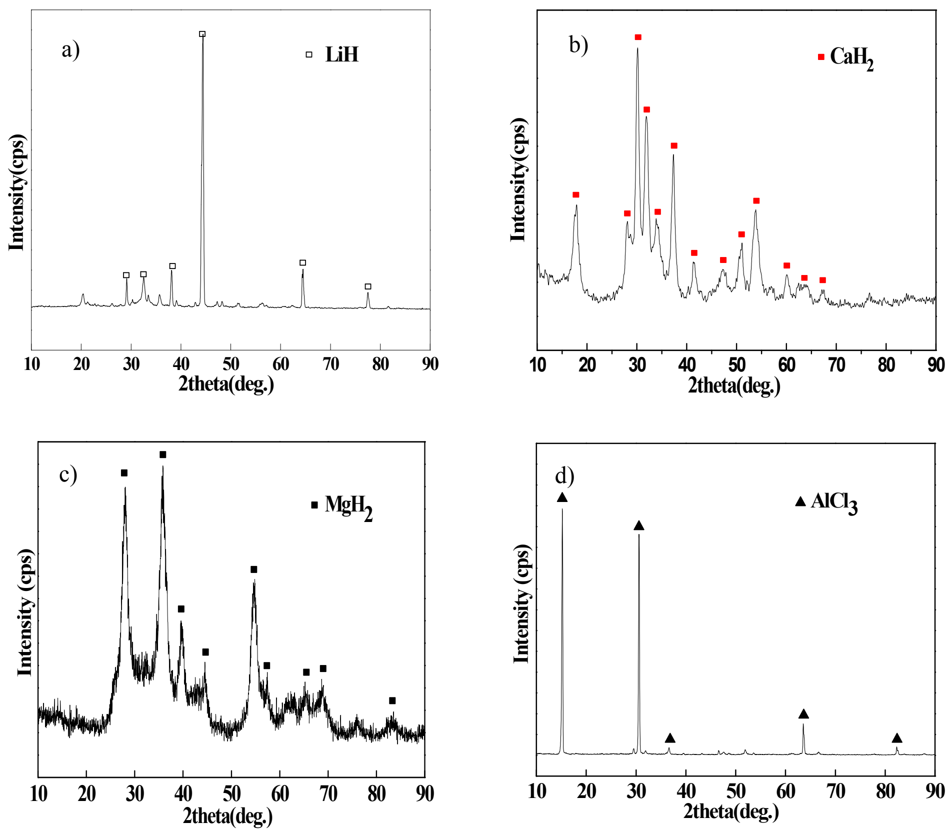

Fig. S1 XRD patterns of a) LiH phase, b) CaH_2 phase, c) Mg powders milled in hydrogen for 20h, d) $AlCl_3$ phase,

It is suggested from Fig. S1c that the solid-gas reaction was completed until milling in hydrogen for 20 h. Subsequently, the MgH_2 phase was fully formed. Calculated by Scherrer equation based on the XRD patterns, the average crystallite size of MgH_2

phase can reach 10 nm.

Figure S2. Proposed reagent of the MgH_2 and $AlCl_3$ phase as identified by SEM

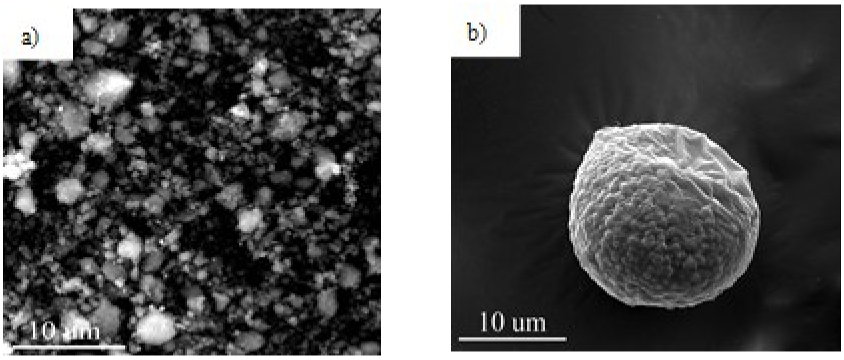

Fig. S2 SEM morphology of a) MgH_2 phase, b) $AlCl_3$ phase..

Upon milling for 20h, it can be seen from the Fig. 2a that most individual particles of MgH_2 were between 1 and 2 μm in size.

Figure S3. The isothermal desorption curves of the MgH_2/$AlCl_3$ powders

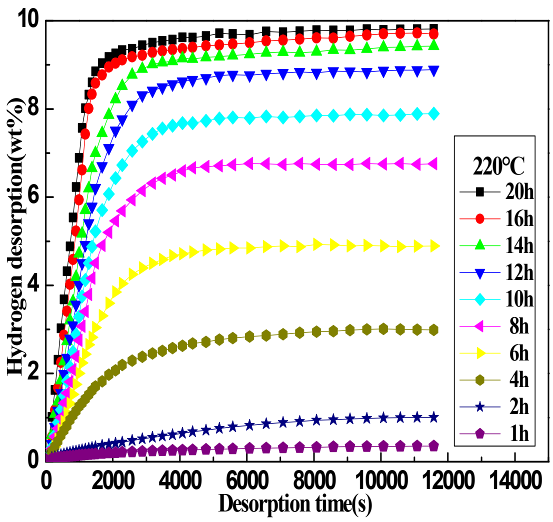

Fig. S3 Isothermal desorption curves of the MgH_2/$AlCl_3$ powders milled at 400 rpm with a ball to powder mass ratio (BPR) of 60:1 for different times.