Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Novel core-shell structured MgH_2/AlH_3@CNTs nanocomposites with extreme high dehydriding-rehydriding properties derived from nanoconfinement

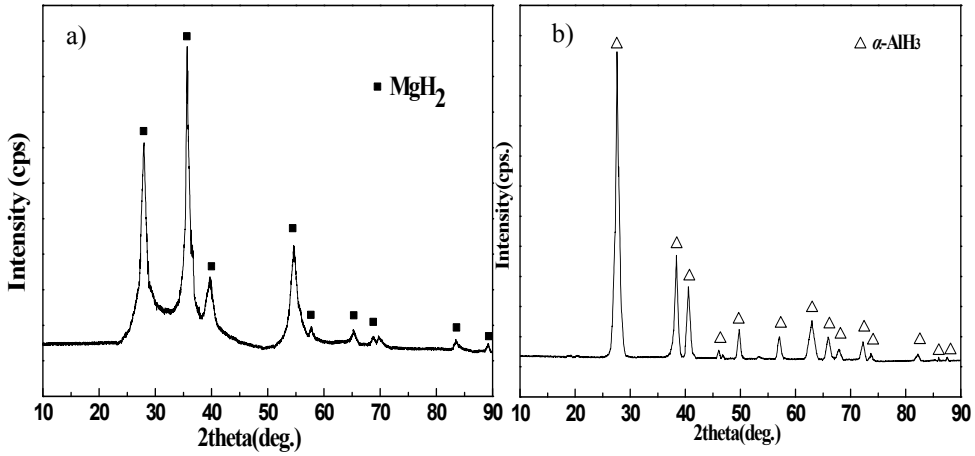


Fig. S1 XRD patterns of as-prepared a) MgH_2 phase, b) AlH_3 phase

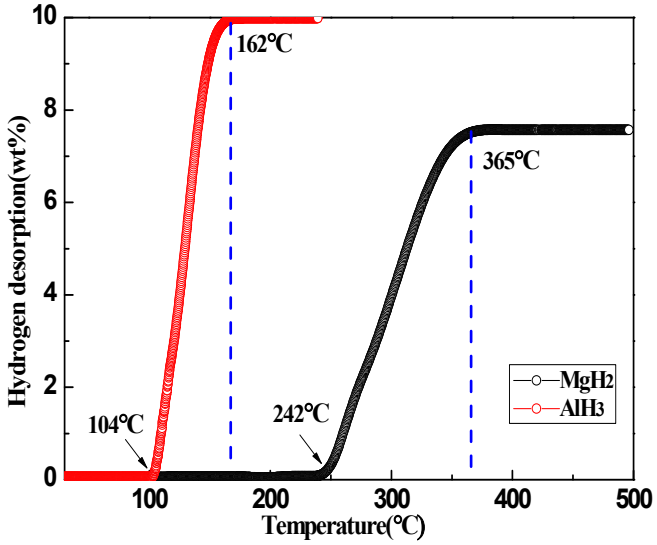
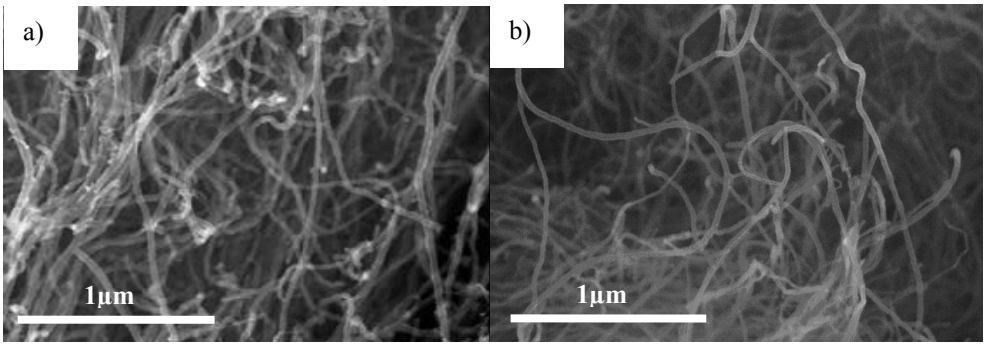


Fig. S2 temperature programmed desorption of a) MgH_2, b) AlH_3. Samples were heated from room temperature to 500 °C with a rate of 10 °C/min.



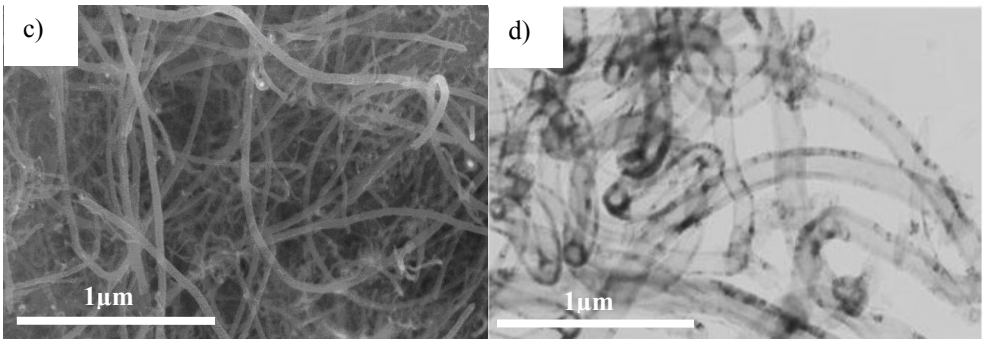


Fig. S3 SEM images of various CNTs: a)CNTs4, b)CNTs1, c)CNTs2, d)CNTs3.

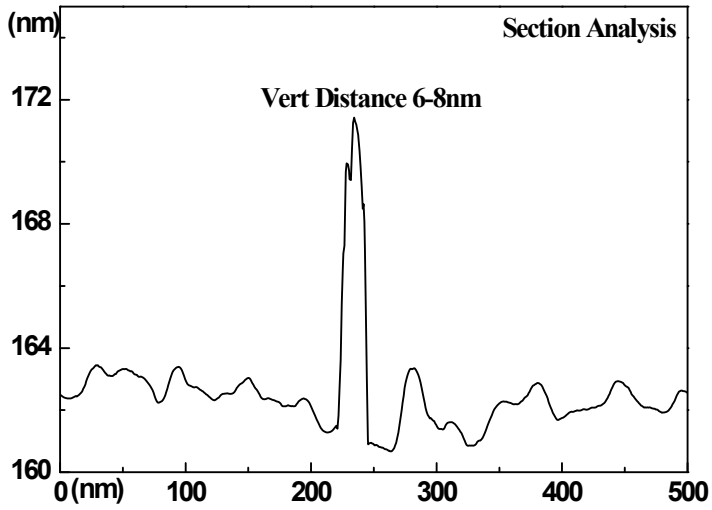


Fig. S4 Section analysis of CNTs4

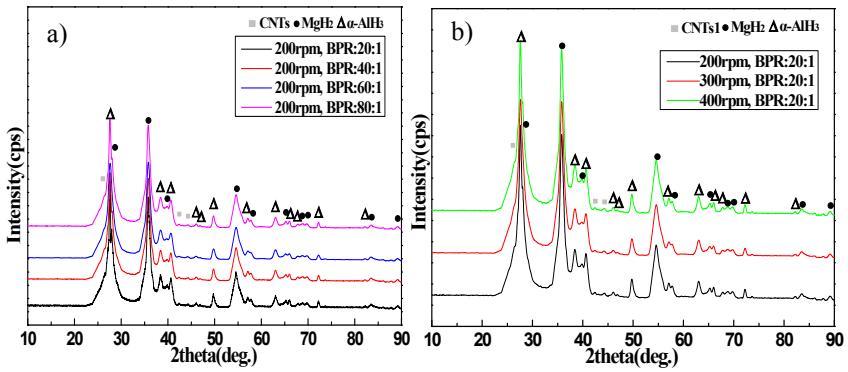


Fig. S5 XRD patterns of as-milled MgH_2/AlH_3@CNTs1 obtained by milling with different ball to powder ratio and rotating speed for 1h

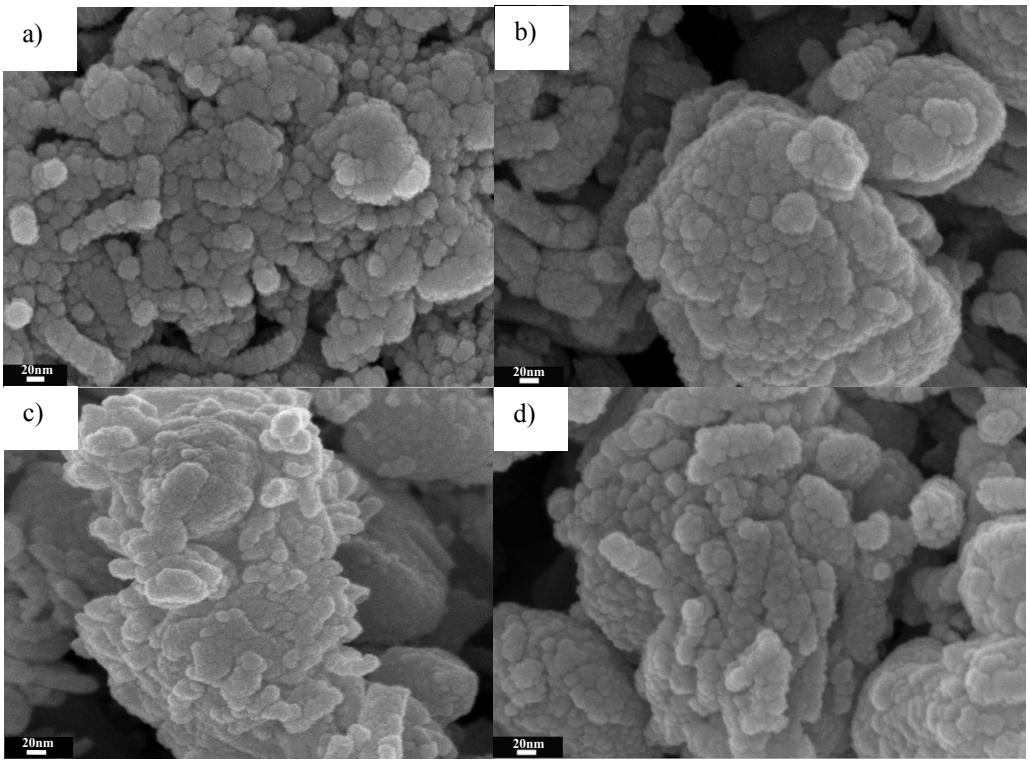


Fig. S6 SEM images of MgH_2/AlH_3 wrapped with various CNTs:a)MgH_2/AlH_3@CNTs4, b)MgH_2/AlH_3@CNTs1, c)MgH_2/AlH_3@CNTs2, d)MgH_2/AlH_3@CNTs3

As can be seen in Fig. S6a, most MgH_2/AlH_3particles wrapped with CNTs4 after milling for 1 h have a size of 60-80 nm, which suggests that the CNTs4 leads to particle size refining of the nano-composite. With the CNTs transforming from 4 to 1, it is obvious that powder agglomeration were observed, with the size of most particles being in the range of 120-150 nm, as shown in Fig. S6b. For MgH_2/AlH_3@CNTs2 and MgH_2/AlH_3@CNTs3, severe agglomeration or aggregation, a phenomenon somewhat like sintering of the powder particles was observed, the morphology of the particles became irregular and difficult to identify, and the size of most particles was estimated to be in the range of 200-250 nm, as shown in Fig. S6c and d.

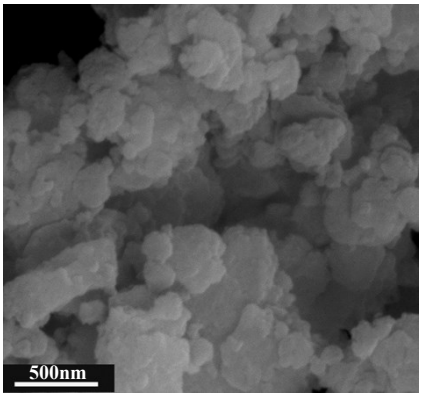


Fig. S7 SEM images of MgH_2/AlH_3 nanoparticles

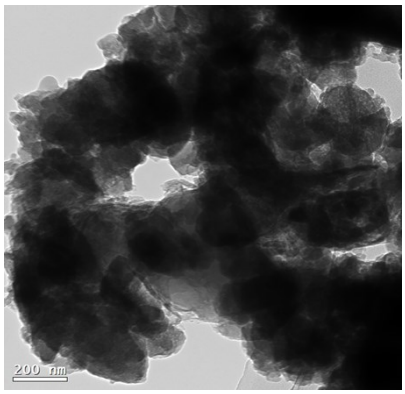


Fig. S8 TEM images of MgH_2/AlH_3 nanoparticles

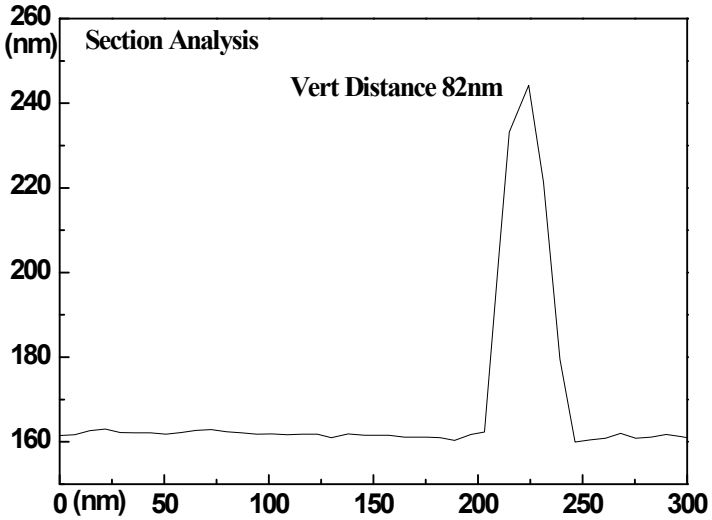


Fig. S9 Section analysis of 95%-2.5MgH_2/AlH_3@5%CNTs4

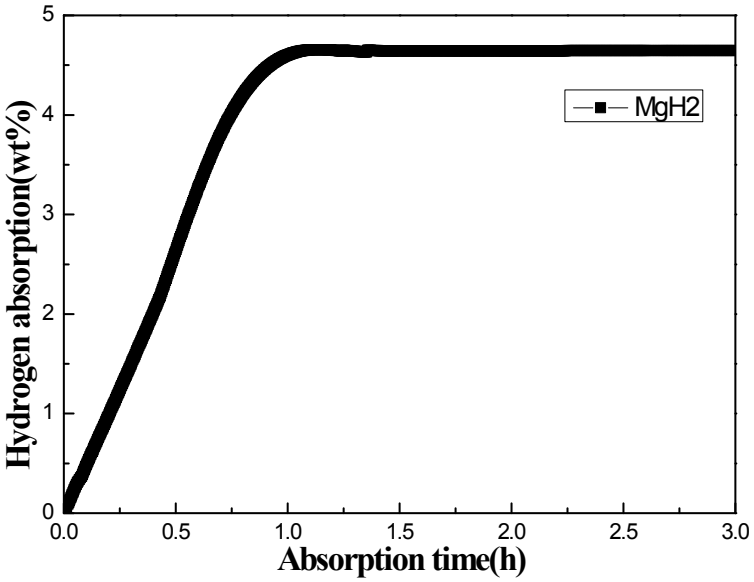


Fig. S10 Absorption property of commercial MgH_2 at 250°C under 5MPa of H_2.