Enhanced hydrogen storage properties of MgH_2 with numerous hydrogen diffusion channels provided by $Na_2Ti_3O_7$ nanotubes

Liuting Zhang [a,b], Lixin Chen [b,*], Xiulin Fan [b,c], Xuezhang Xiao [b], Jiaguang Zheng [b], Xu Huang [b]

[a] School of Energy and Power, Jiangsu University of Science and Technology, Zhenjiang 212003, P.R. China

[b] State Key Laboratory of Silicon Materials, Key Laboratory of Advanced Materials and Applications for Batteries of Zhejiang Province, Department of Materials Science and Engineering, Zhejiang University, Hangzhou 310027, China

[c] Department of Chemical and Biomolecular Engineering, University of Maryland, College Park, MD 20742, USA.

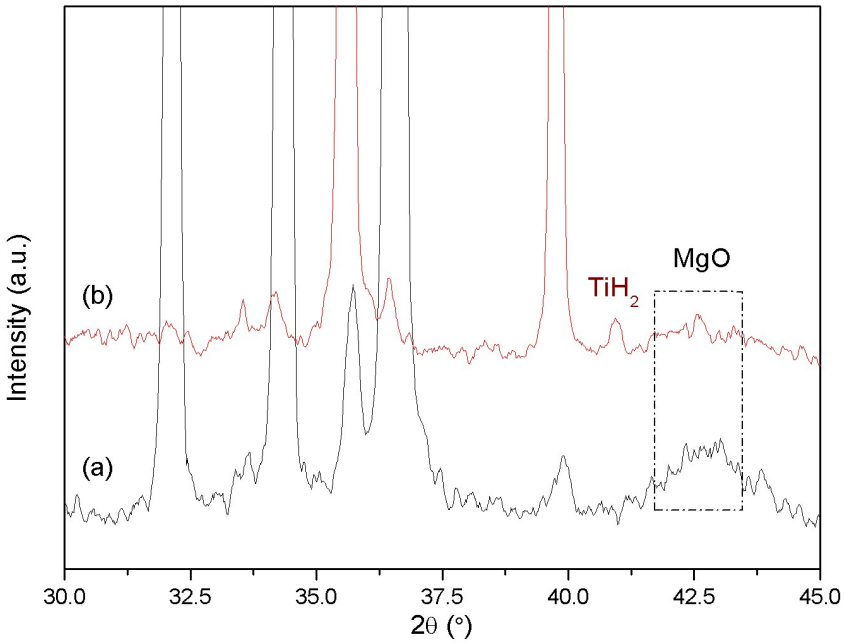

Fig. S1 XRD patterns for (a) dehydrogenated and (b) rehydrogenated MgH_2-$Na_2Ti_3O_7$ NRs composite.

*Corresponding author. Tel./fax: +86 571 87951152.
E-mail address: lxchen@zju.edu.cn (L.X. Chen); xzxiao@zju.edu.cn (X.Z. Xiao).

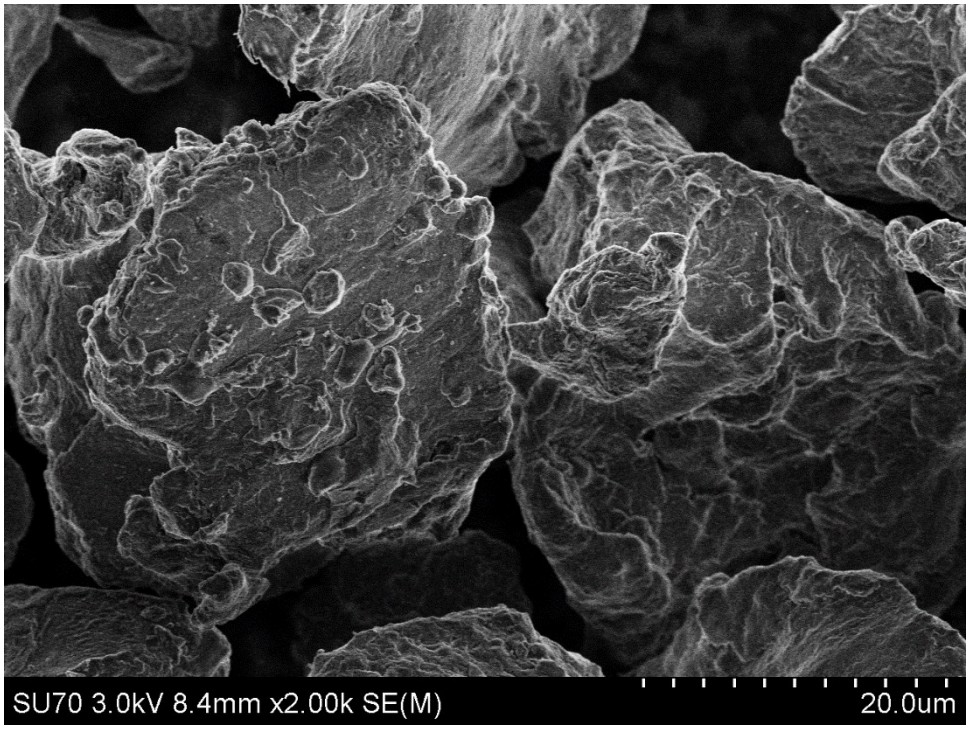

Fig. S2 SEM photograph of bulk MgH_2.[1]

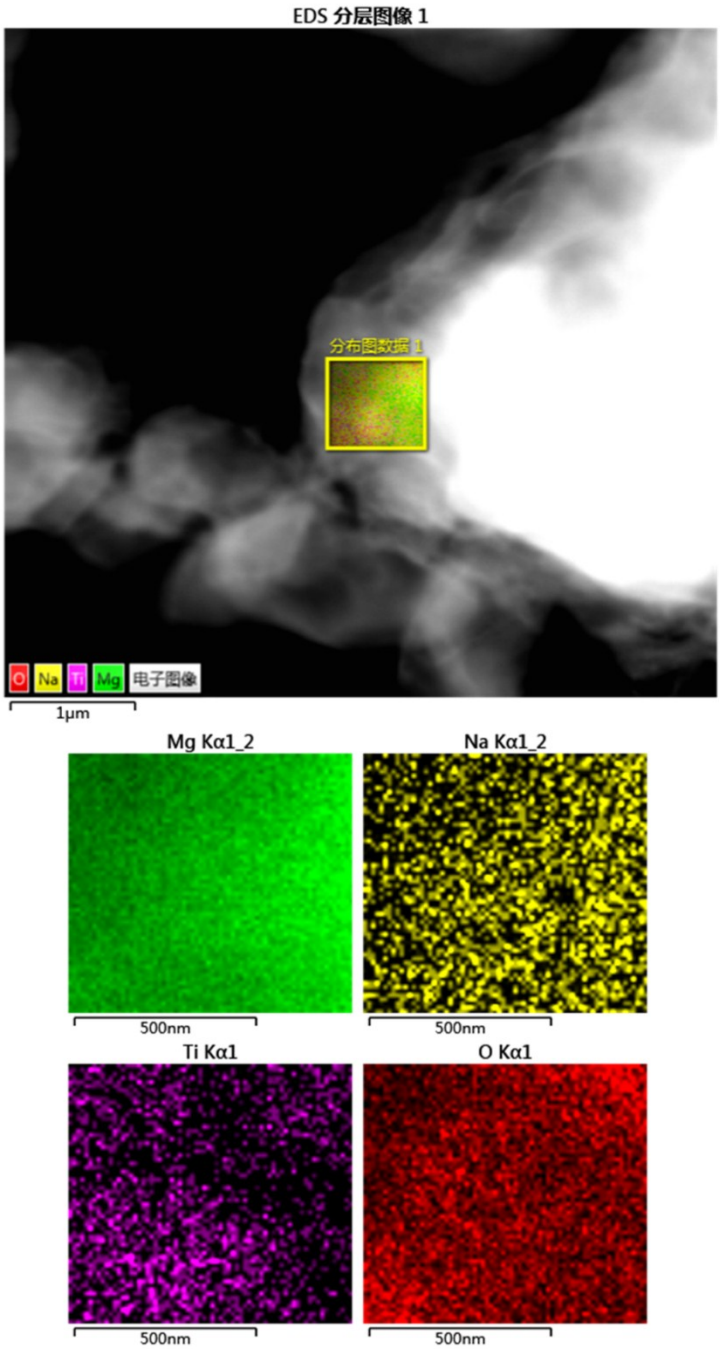

Fig. S3 STEM photograph of MgH_2-$Na_2Ti_3O_7$ NTs composite and corresponding EDX mapping data.

Bulk $Na_2Ti_3O_7$ was synthesized via a reported method[2] and then introduced to MgH_2 to see the catalytic effect of bulk $Na_2Ti_3O_7$. The bulk $Na_2Ti_3O_7$ can also catalyzing the hydrogen desorption of MgH_2. After modified by bulk $Na_2Ti_3O_7$, the MgH_2-$Na_2Ti_3O_7$ composite could release about 5 wt% hydrogen in 250 minutes at 300 ºC (Fig. 1), while bulk MgH_2 could hardly release any hydrogen at the same experimental condition. However, the desorption kinetics of MgH_2-$Na_2Ti_3O_7$ composite is much slower compared with that of MgH_2-$Na_2Ti_3O_7$ NRs and MgH_2-

$Na_2Ti_3O_7$ NTs, which could release 6.5 wt% H_2 within 16 min and 6 min, respectively.

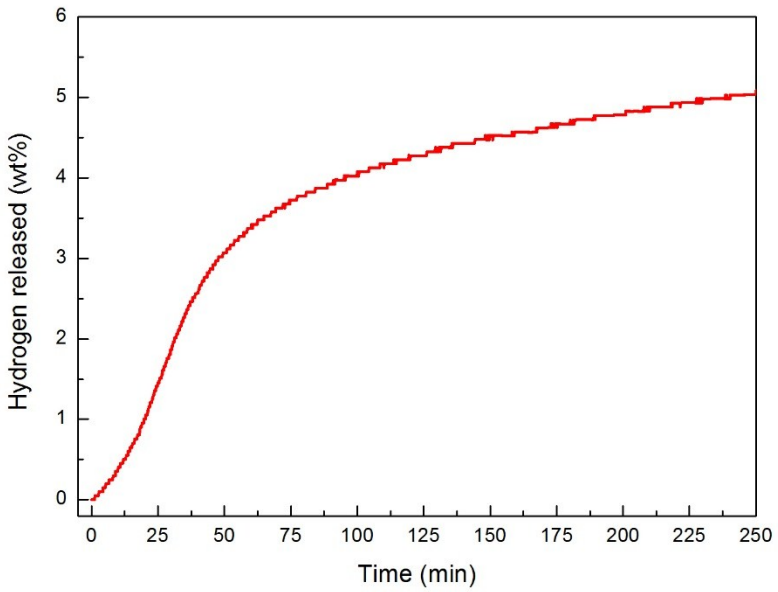

Fig. S4 Isothermal desorption curves of MgH_2-$Na_2Ti_3O_7$ under 3 kPa hydrogen back pressure at 300 ºC.

References

1 L. Zhang, L. Chen, X. Xiao, X. Fan, J. Shao, S. Li, H. Ge and Q. Wang, *Int. J. Hydrogen Energy*, 2014, **39**, 12716-12726.

2 H. Pan, X. Lu, X. Yu, Y. Hu, H. Li, X. Yang, L. Chen, *Adv. Energy Mater.*, 2013, **3**, 1186-1194.