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Hydrogen generation via hydrolysis of Mg_2Si

Z.H. Tan[a], L.Z. Ouyang[a,b]*, J.M. Huang[a], J. W. Liu[a], H. Wang[a], H.Y. Shao[c]*, M. Zhu[a]

[a] School of Materials Science and Engineering, Guangdong Provincial Key Laboratory of Advanced Energy Storage Materials, South China University of Technology, Guangzhou, 510641, People's Republic of China

[b] China-Australia Joint Laboratory for Energy & Environmental Materials, Key Laboratory of Fuel Cell Technology of Guangdong Province, Guangzhou, 510641, People's Republic of China.

[c] Joint Key Laboratory of the Ministry of Education, Institute of Applied Physics and Materials Engineering (IAPME), University of Macau, Macau SAR, China.

ABSTRACT

A convenient, high-density and low-cost hydrogen supply technology is essential to hydrogen energy system by providing hydrogen to fuel cell component. Magnesium silicide (Mg_2Si) can be a good hydrolysis candidate due to its low cost and ability of releasing hydrogen gas during hydrolysis process. However, previous studies have demonstrated that Mg_2Si could easily produce large amount of silanes during hydrolysis reaction, which may cause serious problem of explosive danger when in contact with air. Here it is the first time that Mg_2Si was used for generation of hydrogen by a simple and convenient one-step hydrolysis reaction. In this study, hydrolysis kinetics and mechanisms of Mg_2Si in NH_4Cl and NH_4F solutions were investigated. The silanes could be almost completely turned into hydrogen by introduction of fluorine ion during the hydrolysis reaction of Mg_2Si, leading to very low silanes content in the produced hydrogen. The kinetic studies indicated that when the concentration of the NH_4F solution increased to 13.0%, the hydrogen generation rate and the reaction yield were improved significantly and reached the best performance, producing 466 mL g^{-1} H_2 in 10 min and 616 mL g^{-1} H_2 in 30 min at 25 □. The activation energy was calculated to be 37.3±0.8 kJ mol^{-1}. Furthermore, the hydrogen yield and the hydrolysis rate