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Development of a Hydrogen Production Method by Hydrolysis Reaction between Mg and Seawater

Kunio Matsuzaki, Takashi Murakami

National Institute of Advanced Industrial Science and Technology, Advanced Manufacturing Institute

Summary

The process for the production of Hydrogen by hydrolysis reaction of Mg chips was developed. The Mg chips generated by machining such as cutting or lath were reacted with sea water. This hydrolysis reaction was combined with ball milling process, and the production condition was investigated The Hydrolysis reaction of Mg chips with a particle size below 200 μm generates hydrogen of 160 ml/g for 120min ,meaning 16% of Mg is converted into hydrogen. On the other hand, a hydrogen of 800 ml/g is obtained by the designed process. The process makes it produce hydrogen at 5 times higher compared to the hydrolysis reaction only, and is found to be effective to produce hydrogen. This is maybe that the ball milling causes the fine particle and fresh surface, leading the increase of the reaction rate. The production rate increases with the decrease in grain size of Mg chips. The higher rotation speed of ball milling and the weight of ball, the high hydrogen is generated. At a ratio of the weight of Mg chip to the volume of sea water, 5 g to 250 ml the highest hydrogen production rate is obtained. The salt content of sea water is 3.2%, the increase in the salt content causes no significant increase of hydrogen production rate.

This process was also applied to Mg alloy AZ9, which is commonly used. The AZ91 alloy chips without classification produced by cutting are converted into hydrogen with 800 ml/g by the present process at 300min. The hydrolysis reaction only produces 80 ml/g. It is said that the process is effective for commercial Mg alloy. Mg chips generated by machining are fine, and easily combusted on heating in air before melting, therefore the recycling of the Mg chips is hard. In addition they are classified as hazardous good. After hydrolysis reaction, Mg is changed into Mg $(OH)_2$, which is safe and easy to deal with. It is concluded that the developed process is useful to produce hydrogen from Mg chips effectively and covert into safe materials.