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Hydrogen permeation from ammonia by pulsed plasma membrane reactor

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Highlights

1. Electron energy generated by pulsed DBD plasma decomposed ammonia, and produced molecular hydrogen and H radical.
2. An improvement of the plasma membrane reactor was studied to increase hydrogen production from ammonia.

Abstract

Ammonia is an excellent hydrogen carrier to solve the problems related to hydrogen transportation and storage in the hydrogen economy. Plasma decomposition is a promising technology for hydrogen production. However, high purity hydrogen production for fuel cell is an important issue, because efficiency of fuel cells are dropped by a small amount of ammonia such as 5 ppm[1)]. In this study, pure hydrogen production was performed by plasma membrane reactor (PMR), which is equipped a pulsed plasma reactor and a hydrogen separation membrane.

Characteristics of hydrogen production by the PMR were investigated. The hydrogen permeation rates were increased with an increase in the applied voltage, differential pressure between the feed gas and the product gas, and the partial pressure of hydrogen in the plasma. It found that the PMR was available for pure hydrogen production from ammonia.

Fig. 1 shows variation in H_2 conversions, C_{H2}, with power consumptions of the PMR at the plug. Ammonia flow rates were changed from 0.5 to 1.0 L/min, and the plasma reactor without the membrane (PR) and the PMR were used to compare effect of the membrane. It found that the highest C_{H2} was obtained in the PMR at 0.5 L/min. The C_{H2} in the PMR was higher than that of the PR. In the PMR, produced H radical from ammonia is rapidly permeated the membrane, and ammonia decomposition may be promoted in plasma. The residence time of ammonia in the plasma was also a controlled factor for H radical production.

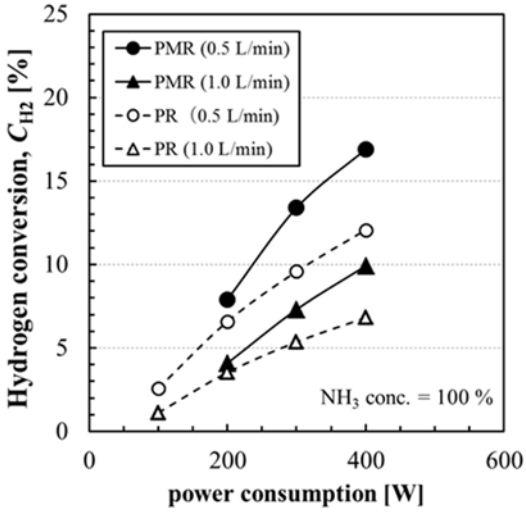
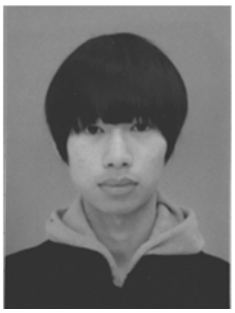


Fig. 1 Variation in Hydrogen conversion in PMR and PR at difference ammonia flow rates.



References

1) Y. MATSUDA, N. YOSHIMURA, *et al*., *JARI Research Journal*, (2013).

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