

# Hydrogen production system from ammonia with zeolite filled plasma membrane reactor

Yukio Hayakawa<sup>1</sup>, Shintaro Wakazono<sup>1</sup>, Akitsugu Sakai<sup>1</sup>, Shinji kambara<sup>1</sup>, Tomonori Miura<sup>2</sup>

<sup>1</sup> Department of Chemistry and Biomolecular Science, Gifu University, Gifu, Japan

<sup>2</sup> Sawafuji Electric Co., Ltd., Gunma, Japan

Type of presentation: Oral

Status of Presenter: Regular

## Abstract (about 150 word with free format)

The bottleneck of realizing a hydrogen energy society is energy loss during hydrogen transport and storage [1]. Ammonia is a promising raw material for hydrogen production because it may solve several problems related to hydrogen transport and storage [2]. Hydrogen can be effectively produced from ammonia via catalytic thermal decomposition; however, the resulting residual ammonia negatively influences the fuel cells. Therefore, a high-purity hydrogen production system comprising a catalytic decomposition reactor and a plasma membrane reactor (PMR) has been developed.

In this study, the state of plasma firing was improved by filling dielectric in the PMR. A columnar zeolite (Tosoh Corporation) was used as a dielectric. By packing the zeolite in the PMR, the hydrogen generation performance of the PMR was also improved. It was also found that the improvement of the production performance is affected by the properties of the zeolite to be filled. The hydrogen refining flow rate obtained 302 L-H<sub>2</sub>/h from 210L-NH<sub>3</sub>/h. The hydrogen yield of this hydrogen production system improved from 16 % to 96 %.

## Reference

- [1] Hennicke, P., and Fishedick, M. Towards. Sustainable Energy Systems: The Related Role of Hydrogen. Energy Policy 2006; 34:1260-70.
- [2] O. Elishav, D. R. Lewin, G. E. Shter, G. S. Grader. The nitrogen economy: economic feasibility analysis of nitrogen-based fuels as energy carriers. Applied Energy 2017;185:183–188.