HYDROGEN PRODUCTION FROM BIOMASS USING NUCLEAR FUSION ENERGY

H. Kimura, Y. Takeuchi, Y. Yamamoto and S. Konishi
Institute of Advanced Energy, Kyoto Univ., Gokasho, Uji, Kyoto 611-0011, Japan
+81-0774-38-3434, h-kimura@iae.kyoto-u.ac.jp

Hydrogen deserves of a future energy medium in terms of global environmental issues and fossil resource constraints. For hydrogen production, a variety of processes such as thermo-chemical decomposition or electrolysis of water using nuclear energy is under development. The authors proposed a hydrogen production from biomass using nuclear thermal energy. This study intends to analyze effects of various factors on the gas generation rate, and to identify technical issues to develop practical hydrogen production process to be applied to the nuclear heat sources performance when applied in a system.

A process that yields hydrogen from biomass is formulated as (C6H10O5)n + mH2O _ 6nH2 + 6nCO - 814kJ. Namely, the process is such that it decomposes cellulose, a principal component of biomass, mostly to H2 and CO by supplying steam and heat generated by nuclear energy. An additional shift reaction contributes to yield 12H2.

Our preliminary experiments suggested the conversion of cellulose to H2 and CO at a reaction temperature of 1000 deg C without catalyst. Increase in reaction temperature results the decomposition of residual char and tar, improving gasification efficiency. The maximum quantity of hydrogen obtained in the experiment was 34 percent of a theoretical value. Simultaneously, the quantity of heat absorbed by the endothermic reaction by the cellulose gasification process was evaluated.

Based on the experimental results, the concept of the hydrogen production process was examined. It is expected that the process can produce 110 t/h of hydrogen with 3 GW equivalent nuclear reactor and is regarded as an attractive alternative for other methods.

The results of the optimization of the reaction condition for biomass gasification efficiency, and the measurements of the reaction rate that is required to design a practical reactor to utilize external heat source will be reported.