NUMERICAL ANALYSIS OF ENDOTHERMIC QUANTITY IN HYDROGEN PRODUCTION FROM BIOMASS USING NUCLEAR THERMAL ENERGY

Y. Takeuchi, H. Kimura, Y. Yamamoto and S. Konishi
Institute of Advanced Energy, Kyoto Univ., Gokasho, Uji, Kyoto 611-0011, Japan
+81-774-38-3432, y-takeuchi@iae.kyoto-u.ac.jp

Numerical analysis has been made for estimating endothermic quantity during a hydrogen production process using a reaction of biomass decomposition. The authors have already reported that the use of nuclear fusion thermal energy permits hydrogen production with high efficiency to be achieved when applying the present process. The process has the feature in its heat supplying method being provided by thermal medium from outside a system, for which the application of new technology will be required. So, it is important to evaluate endothermic quantity, which should be less than or equivalent to the heat supplied from the outside of the system to sustain the reaction, for estimation of hydrogen production rate for a wide range of conditions. In this study, the numerical solution of temperatures will be obtained for estimating endothermic quantity of biomass resource.

A Numerical model has been established on the basis of the geometry of the test section installed in authors' experimental apparatus. The model takes account of the combined heat transfer problems composed of forced convection of gas flow, heat conduction through a test pipe, radiative heat transferred from the outside of the pipe, and heat absorption caused by biomass itself. In numerical analysis, two dimensional governing equations for the conservation of mass, momentum, and energy have been applied to solve the heat and fluid flow, with appropriate boundary conditions.

The numerical results are compared with the authors' experimental data that have been obtained at reaction temperatures ranging from 800 to 1000 deg C, to verify the numerical model as well as simulation procedure. After verifying the validity of the present numerical analysis, numerical solution will be obtained for a wide range of parameters such as pipe diameter, reaction temperature, and flow velocity. Based on the numerical results, basic examinations will be made for the determination of the heat supply method to the reactor system, in which the process proceeds, and of a design of a heat exchanger installed by the reactor.