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Activities of the Core

Sep. 7, 2024	The 4th Higashihiroshima-Ene/Eco Seminar (co-organized by HU-ACE)
Sep. 17, 2024	The 15th Hiroshima University Biomass Premium Evening Seminar (co-organized by HU-ACE)
Sep. 29, 2024	The 95th HU-ACE Steering Committee Meeting

Professor promotion

Thanks to support and help from various people, our staff could make considerable achievements, which led to the promotion of one associate professor to professor as of April 1, 2024.

Prof. Yoichi Ogata

I have been promoted to Professor of the Mechanical Engineering Program at the Graduate School of Advanced Science and Engineering this April. I would like to express my deepest gratitude to all of you for your support and guidance.
I intend to engage in research activities based on fluid engineering and computational fluid dynamics in the reduction of energy loss and improvement of utilization efficiency in powertrains, mainly for automobile development toward a global perspective on energy and environmental issues. Moreover, I will continue to promote educational activities so that graduates from Hiroshima University can play an active role in a variety of fields.
Thank you for your continued support and encouragement.

Related Events

Oct. 3, 2024: 16:20-17:50 The 116th Hiroshima University Biomass Evening Seminar
Nov. 8, 2024: 16:20-17:50 The 117th Hiroshima University Biomass Evening Seminar
Jan. 11-12, 2025: JCREN2025 (https://i-aeu.org/250111jcren/)

Contact us for more information : hu-ace-info@ml.hiroshima-u.ac.jp

We have constructed a roadmap for the development of energy utilization technologies leading up to 2050 and an integration scenario called the “Hiroshima Scenario”. Please feel free to share your thoughts with us.
https://hu-ace.hiroshima-u.ac.jp/wp/wp-content/uploads/2022/10/220921-brochure.pdf

Research consultation and joint research are welcome.

Issued by Advanced Core for Energetics, Hiroshima University
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Research Topics

Evaluation Glucose Gasification Efficiency with Ru/CNT Catalyst in Supercritical Water

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Research fields: Supercritical water gasification, Thermal Engineering.
Keywords: Supercritical water gasification (SCWG), Carbon nanotubes (CNTs), Catalyst, Glucose

Abstract

Background

To realize a sustainable society, it is desirable to use biomass instead of fossil fuels[1]. Biomass accounts for only about 4% of electricity generation in Japan, and its effective utilization will contribute to solving the problem of energy resource shortage in Japan.

Supercritical water gasification (SCWG) is a promising technology for efficiently converting biomass into useful gases. Carbon nanotubes are expected to be utilized as catalyst supports due to their large specific surface area and chemical stability. In this process, catalysts play an important role in accelerating the reaction and improving gas yields. A catalyst consisting of Ru supported on CNTs performed well, and achieved complete gasification under various supercritical water conditions.

Methods

Gasification was performed as shown in Fig. 1, using 5 wt% glucose as a feedstock at a temperature of 600 ° C, pressure of 25 MPa, and flow rate of 2 mL/min. The amount of the catalyst changed from 0 g to 0.15 g. The temperature increased while water flowed through the reactor until the target temperature was reached. After the target temperature was reached, the flow changed from water to feedstock, and sample collection began 45 minutes later to ensure that the steady state is achieved. Liquid samples were collected first, followed by gas samples. The experiment took approximately 90 minutes from the time of switching to the feedstock to the end of sample collection. The carbon yield and gas composition of the collected gas and liquid products were measured using gas chromatography and a total organic carbon meter.

Results

The results of supercritical water gasification of a 5 wt.% aqueous glucose solution as the raw material, at 600 ° C and 25 Mpa, indicates that reducing the amount of Ru/CNT catalyst used had little effect on gasification in terms of carbon balance.

Full gasification could not be achieved at either 0.0375 g or 0.0188 g of catalyst. However, the 0.15 g of Ru/CNT catalyst enhances the reaction to achieve complete gasification.

When the amount of catalyst is reduced, the carbon gasification efficiency decreases, indicating that the gasification reaction is promoted by the catalyst. The experimental results were well represented by the results predicted by the first-order reaction model.

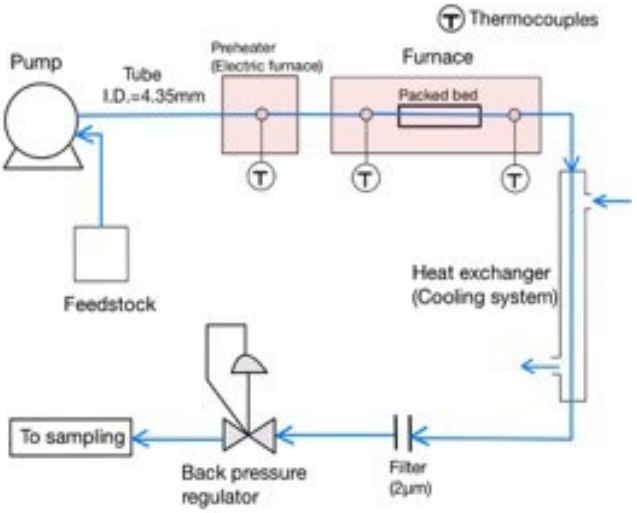

Fig. 1. Experimental apparatus

References

1. Sansaniwal, S. K., et al. (2017)., 72, 363-384.