Advanced Core for Energetics, Hiroshima University Vol. 75

HU-ACE NEWS LETTER

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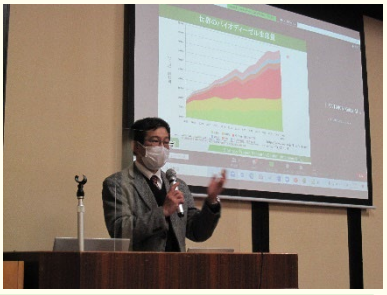
Activities of the Core

Mar. 6, 2023	The 27th Hiroshima University Biomass Project center Symposium (co-organized).
Mar. 8, 2023	The 77th HU-ACE Steering Committee Meeting.
Mar. 13, 2023	The 9th Hiroshima University Biomass Premium Evening Seminar (co-organized).
Mar. 20, 2023	Post-Symposium the 3rd Anniversary of the Graduate School of Advanced Science and Engineering (co-organized).

Biomass Symposium was held.

On March 6, 2023, the co-organized Biomass Symposium “Workshop: Biofuels from the basics” was held as a hybrid event. This symposium was held face-to face for the first time in three years. After greetings from the head of HU-ACE, Prof. Yukihiko Matsumura, four lectures were given by Prof. Yutaka Nakashimada, Prof. Yukihiko Matsumura, Prof. Misturu Aoyagi, and Prof. Yoshimitu Uemura. The lectures were given with the aim of explaining the basics of biofuels in an easy-to-understand manner, introducing research seeds, and introducing the development and dissemination of biomass utilization technologies. After the lecture, there was a Q&A session and a lively exchange of opinions between online participants and on-site participants. It was a meaningful symposium that explained the current situation, cost issues, and progress in technological development in an easy-to-understand manner. We would like to thank everyone who was involved.



Related events

The 7th International Symposium on Fuels and Energy (ISFE 2023) will take place on July 3-4, 2023. We are preparing for a hybrid format event, including on-site participation at the Higashihiroshima Art and Culture Hall "Kurara“, and online participation via ZOOM. Please visit the following ISFE 2023 website for more details.
https://symposium2023.isfe.hiroshima-u.ac.jp

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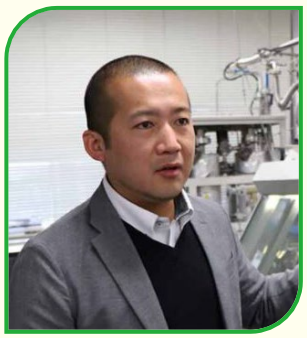
Research Topics

Utilization of functional property of alkali metal — Innovative NH_3 synthesis H_2 production —



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Research fields: Material science, Material / Energy conversion
Keywords: Nitride synthesis, H_2 storage, H_2 production

Abstract

Background

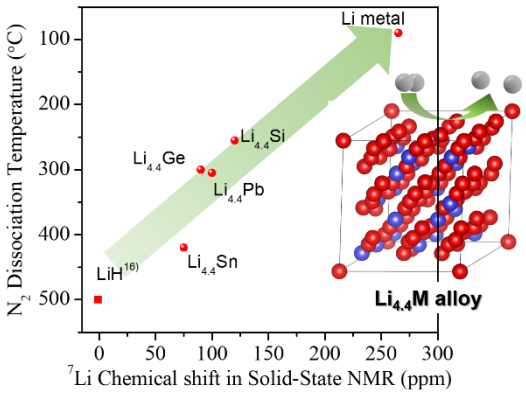
To suppress CO_2 emissions using fossil fuels and overcome energy issues in the future, enhancement of natural energy utilization is necessary. Various conversion techniques, which produce H_2 as energy media and energy carriers, such as NH_3 with high energy density, should be developed to establish energy systems based on fluctuated and localized natural energy.

Methods

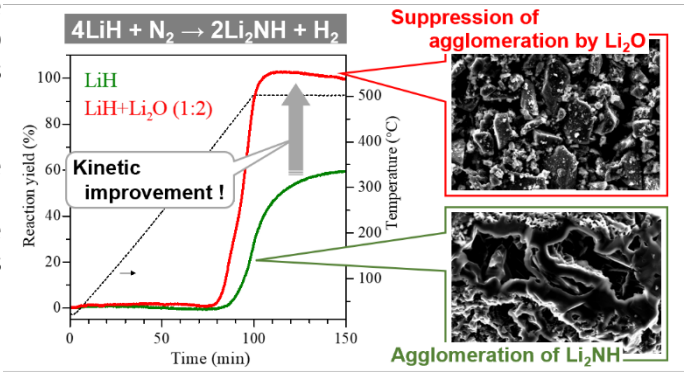
We focus on functional properties of alkali metals such as high reactivity and low melting points, and propose innovative material conversion techniques by controlling the above functions. In particular, we are experimentally studying small-scale / distributed types of ammonia (NH_3) synthesis systems and thermochemical hydrogen production techniques via water splitting which is operated below 500 °C and obtained from unused heat energy.

Results

We proposed a NH_3 synthesis technique based on functional properties such as high dissociation features and diffusion rate of Li, and experimentally investigated the reaction properties. As a result, we have clarified that NH_3 can be produced at an ambient pressure by chemical looping composed of three reactions using Li alloys. Also, that the nitrogen dissociation properties are related to the chemical state of Li in the alloys (upper figure).



The chemical looping using LiH, can also generate NH_3 at an ambient pressure through 2-step exothermic reactions. The main issue of this process is poor kinetics, and we have found through detailed analyses that the melting and condensation of intermediate phase during the reaction slows reactions. The mixing of lithium oxide with LiH as a scaffold to suppress the condensation drastically improves the kinetics (lower figure)



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[2] Tagawa, K.; Gi, H.; Shinzato, K.; Miyaoka, H.; Ichikawa, T.: Improvement of Kinetics of Ammonia Synthesis at Ambient Pressure by the Chemical Looping Process of Lithium Hydride. *J. Phys. Chem. C*. **126**, 2403 (2022).