Advanced Core for Energetics, Hiroshima University Vol. 80

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Activities of the Core

Aug. 1, 2023	The 4th Geoseminar (organized by HU-ACE)
Aug. 23, 2023	The 82nd HU-ACE Steering Committee Meeting

HU-ACE Holds the "Kids Energy Symposium 2023"

The Kids Energy Symposium 2023, co-organized by the HU-ACE, was held on July 29, 2023 at Hiroshima University's Higashi-Hiroshima Campus. In total, 50 elementary school students between 3rd and 6th grade and their parents joined the event. Lectures, quiz competitions, and science experiments were held from 1 pm to 4:30 pm. With the cooperation of Mazda Motor Corporation, a talk was held about how to extract oil from algae, and souvenirs of writing pads and paper car crafts were distributed to the participants. In the quiz competition, prizes were given to several children who achieved excellent results during the competition. In addition, participants enjoyed three different science experiments designed to promote interest in energy. The experiments were titled “Let’s Cool Off with Water”, “Let’s Make Electricity”, and “Let’s Make a Fountain”. This symposium was suspended due to COVID-19 the last few years, but it has since re-started and will continue to be held in the future.

Related Events

The 8th International Symposium on Fuels and Energy (ISFE2024) is scheduled on July 1-2, 2024. Details will be announced later.

We have constructed a roadmap for the development of energy utilization technologies leading up to 2050 and an integration scenario colled 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 No. 44

Hydrogen carrier: ammonia borane-ammonia system

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Research fields:
Materials science and materials engineering.

Keywords: Hydrogen storage, ammonia storage, reversible storage.

Abstract

Background

Hydrogen is vital to for actualizing a carbon-neutral society and constructing a new energy supply system to replace traditional ones. The efficient storage of hydrogen should be the key issue in the development of a hydrogen based system. However, the less volumetric density of hydrogen makes it challenging for practical application. Thus, the management of a suitable hydrogen storage system should be considered. Ammonia is another important hydrogen carrier but is also an excellent solvent, thus here it is utilized as the storage medium for the hydrogen source materials of ammonia borane.

Methods

We used the ammonia in ammonia borane for storage and evaluated the durability of this system. We evaluated the thermodynamic properties of the ammonia borane-ammonia system, the physical properties such as density and kinematic viscosity, and the stability of ammonia stored in liquid ammonia by various techniques.

Results

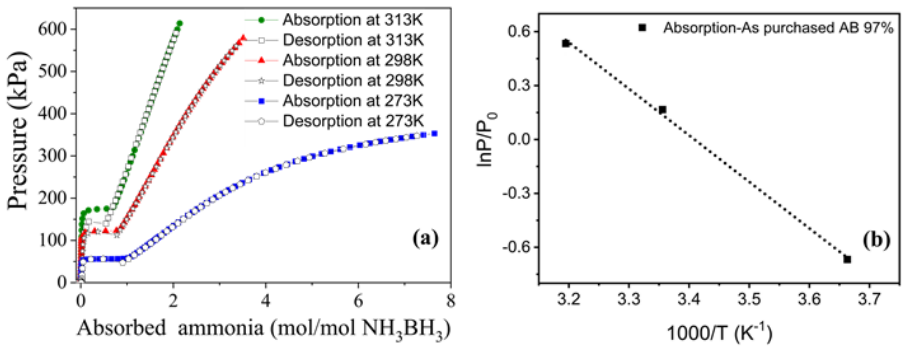

Fig.1 PCI curves of AB at a different temperature (a), the van't Hoff plot (b).

This study evaluated the use of ammonia borane and liquid ammonia for hydrogen storage and transportation. The thermodynamic parameters (shown in Fig.1) and physical properties of ammonia absorption by ammonia borane are evaluated as potential hydrogen and/or ammonia storage systems for both hydrogen and borane transportation. The volumetric and gravimetric hydrogen densities of the ammonia borane-ammonia system were higher than those of liquid ammonia under the vapor pressure of 0.1 MPa. The results also show that ammonia can be completely removed from ammonia borane. The system has moderate kinematic viscosity and high stability at room temperature. Therefore storing ammonia borane in liquid ammonia is efficient for hydrogen transportation, but temperature control is important. Overall, these findings provide insights into the potential applications of the ammonia borane-ammonia system in the field of energy storaged.

References

1. F. Guo et al.: Int. J. Hydrogen Energy, 48, 27298-27303 (2023).