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Activities of the Core

Oct. 3, 2024	The 116th Hiroshima University Biomass Evening Seminar (co-organized by HU-ACE)
Oct. 12, 2024	The 5th Higashihiroshima-Ene/Eco Seminar (co-organized by HU-ACE)
Oct. 17, 2024	The 96th HU-ACE Steering Committee Meeting
Oct. 25, 2024	The 2nd Energy Storage Seminars (organized by HU-ACE)

“Higashihiroshima Energy-Eco Seminar” Now Being Held

The second series of the “Higasihiroshima Energy-Eco Seminar” is being held this year, following last year's one, co-hosted by Higashi-Hiroshima City and the A-ESG Science and Technology Research Center. The program started in June and will continue through February next year for a total of nine seminars. This program is a series of seminars for upper elementary school students and above to learn about energy technology and the environment in a fun way. Each seminar discusses a different theme with an atmosphere different from that of a regular classroom. The questions are many and the quiz contest, with prizes for the top three winners, is also a lot of fun. The following are the themes of the seminars. Five seminars have finished as of the end of October.

Part 1: Jun 15, “Why is the Earth's Temperature Rising? -Global Warming”
Part 2: Jun 22, “Using Energy from Grass and Trees -Biomass”
Part 3: Jul 6, “The University's Challenge to Reach Zero Carbon”
Part 4: Sep 7, “Energy-Saving Air-Conditioning with Heat from the Earth -Geothermal Heat”
Part 5: Oct 12, “Burning Hydrogen, a Clean Fuel that Emits No Carbon Dioxide”
Part 6: Nov 9, “Zero Carbon City Higashi-Hiroshima”
Part 7: Dec 7, “Clean Power Generation by Sunlight -Solar Cells”
Part 8: Jan 25 “Can We Realize the Sun on Earth -Nuclear Fusion”
Part 9: Feb 1 “Collecting and Using Carbon Dioxide -Carbon Recycling”

Related Events

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
HU-ACE Secretariat, URA Division, Office of Research and Academia-Government-Community Collaboration, Hiroshima University 1-3-2 Kagamiyama, Higashi-Hiroshima, 739-8511 Japan
E-mail: hu-ace-info@ml.hiroshima-u.ac.jp, tel:+81-82-424-4425, URL: https://hu-ace.hiroshima-u.ac.jp/en/

HU-ACE NEWS LETTER Advanced Core for Energetics, Hiroshima University Vol. 94

Research Topics

No. 57

Combustion characteristics of lithium-ion battery thermal runaway vent gas in the air

Wookyung Kim

Associate Professor, Graduate School of Advanced Science and Engineering

Research fields : Dynamics of reactive gases, Explosion, Combustion
Keywords: Gas and dust explosions, Flame propagation dynamics, Hydrogen safety, Metal combustion, Microgravity combustion,

Abstract

Background

Lithium-ion batteries are widely recognized for their high energy density; however, improper use can result in short circuits or overcharging, leading to exothermic reactions that may induce thermal runaway and, in turn, precipitate fire or explosion events. The vent gas released from Li-ion batteries contains flammable gases, with its composition varying according to the State of Charge (SOC) (Fig. 1). When this vent gas mixes with atmospheric air, it presents a significant risk of secondary explosions, underscoring the importance of understanding its combustion characteristics to prevent Li-ion battery-related explosions. This study employs both experimental and numerical approaches to investigate the combustion characteristics of vent gas emitted from Li-ion batteries.

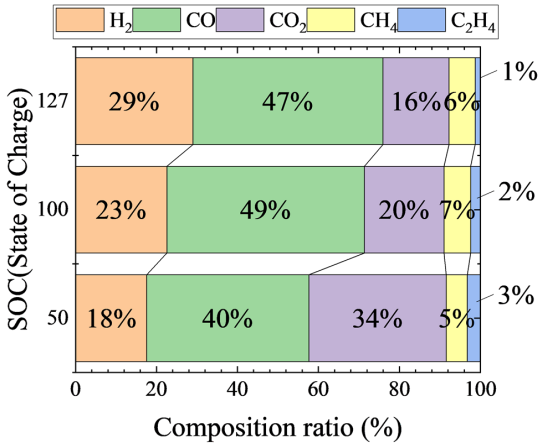

Fig. 1. Composition ratios of lithium-ion battery at different SOC.

Results

A comparison between experimental and computational results revealed a strong correlation in the variation of laminar burning velocities across different equivalence ratios (Fig. 2). The findings indicate that laminar burning velocity increases with the State of Charge (SOC). Additionally, the study explored the impact of chemical reaction mechanisms that significantly contribute to the observed increase in laminar burning velocity at higher SOC levels. Specifically, elevated SOC was found to enhance H2 branching reactions, leading to an increased concentration of OH radicals within the mixture. Consequently, this accelerated the rate-limiting oxidation reactions of hydrocarbons, thereby augmenting the laminar burning velocity. Concerning the role of hydrocarbons in the vent gas mixture, under SOC50 conditions, the CO production rate within the flame zone surpassed its consumption rate, resulting in a slight increase in the CO mole fraction near the flame. For a comprehensive account of the research findings, please consult the referenced paper [1].

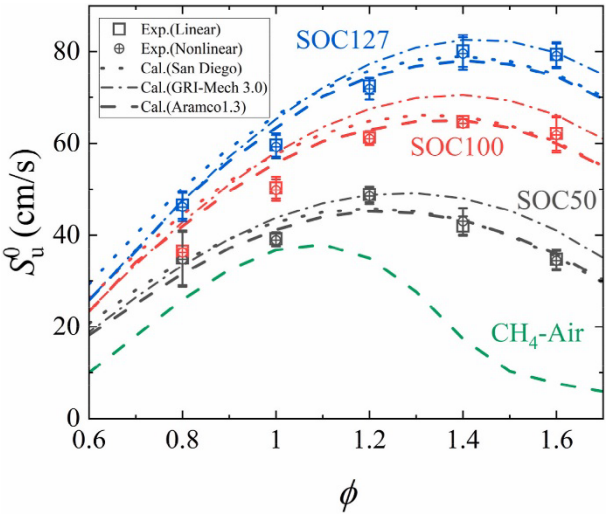

Fig. 2. Laminar burning velocity as a function of equivalence ratio at different SOC.

References

1. A Ueda, Y Kim, W Kim, Laminar burning velocity of lithium-ion battery thermal runaway vent gas in air, *J. Loss Prev. Process Ind.* 89 (2024) 105293.