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Section

Energy Systems

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Section Information

The Energy Systems section of Processes is the ideal forum for the publication of significant high-excellence and high-impact research, as well as reviews. Emphasis is placed on contributions that focus on methodological scientific frameworks to arrive at realistic integrated solutions for complex energy problems by adopting a holistic, systems-based approach. Research papers submitted in the Energy Systems section of Processes are expected to demonstrate novel energy systems and engineering-based approaches to systematically quantify different options at different levels of complexity (technology, plant, energy supply chain, mega-system) through experimental, pilot-scale, energy modeling, simulation, control, and optimization-based frameworks and potentially using real-life applications. The aim of the Energy Systems is to mirror the importance of fundamental and applied research in energy system engineering applications, developing mechanisms for the transfer of new technology to society and industry.

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Selected Papers

https://doi.org/10.3390/pr10061192

A Review of Lithium-Ion Battery Thermal Runaway Modeling and Diagnosis Approaches

Authors: Manh-Kien Tran, Anosh Mevawalla, Attar Aziz, Satyam Panchal, Yi Xie and Michael Fowler

Abstract: Lithium-ion (Li-ion) batteries have been utilized increasingly in recent years in various applications, such as electric vehicles (EVs), electronics, and large energy storage systems due to their long lifespan, high energy density, and high-power density, among other qualities. However, there can be faults that occur internally or externally that affect battery performance which can potentially lead to serious safety concerns, such as thermal runaway. Thermal runaway is a major challenge in the Li-ion battery field due to its uncontrollable and irreversible nature, which can lead to fires and explosions, threatening the safety of the public. Therefore, thermal runaway prognosis and diagnosis are significant topics of research. To efficiently study and develop thermal runaway prognosis and diagnosis algorithms, thermal runaway modeling is also important. Li-ion battery thermal runaway modeling, prediction, and detection can help in the development of prevention and mitigation approaches to ensure the safety of the battery system. This paper provides a comprehensive review of Li-ion battery thermal runaway modeling. Various prognostic and diagnostic approaches for thermal runaway are also discussed.

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https://doi.org/10.3390/pr10010130

Fundamental Study on Hydrogen Low-NOx Combustion Using Exhaust Gas Self-Recirculation

Authors: Kenta Kikuchi, Tsukasa Hori and Fumiteru Akamatsu

Abstract: Hydrogen is expected to be a next-generation energy source that does not emit carbon dioxide, but when used as a fuel, the issue is the increase in the amount of NOx that is caused by the increase in flame temperature. In this study, we experimentally investigated NOx emissions rate when hydrogen was burned in a hydrocarbon gas burner, which is used in a wide temperature range. As a result of the experiments, the amount of NOx when burning hydrogen in a nozzle mixed burner was twice as high as when burning city gas. However, by increasing the flow velocity of the combustion air, the amount of NOx could be reduced. In addition, by reducing the number of combustion air nozzles rather than decreasing the diameter of the air nozzles, a larger recirculation flow could be formed into the furnace, and the amount of NOx could be reduced by up to 51%. Furthermore, the amount of exhaust gas recirculation was estimated from the reduction rate of NOx, and the validity was confirmed by the relationship between adiabatic flame temperature and NOx calculated from the equilibrium calculation by chemical kinetics simulator software.

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