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Editorial: Thermodynamic properties for function fluids in energy utilization

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Editorial on the Research Topic
Thermodynamic properties for function fluids in energy utilization

1 Introduction

The world is currently confronting serious environmental challenges. Developing efficient new thermal system and environmental protection working medium is an effective way to solve the environmental problems. Cooperating with carbon dioxide absorption technology and new energy storage technology, and developing new energy technology, is the key for human to start the new life in the future.

This Research Topic focuses on advancing energy utilization systems and developing new environmentally friendly fluids. Key areas of investigation include CO_2 capture technology, energy storage science and technology, advanced energy-saving techniques, and new types of fuels. Our research investigates the thermodynamic properties of new functional fluids such as ionic liquids, biofuels, and new refrigerants. Additionally, new thermal systems for energy utilization, including CO_2 capture systems, photovoltaic technologies, and advanced refrigeration and energy-saving systems are explored.

2 Summary

In this research topic "Thermodynamic properties for function fluids in energy utilization," four papers have been accepted, which are mainly about the refrigerants and nanofluid adsorption and molecular dynamics (Chen), comparative study of thermally integrated pumped thermal energy storage based on the organic Rankine cycle with different working fluid pairs (Jiang et al.), a CFD numerical simulation of particle deposition characteristics in automobile tailpipe (Zhang et al.) and a semi-analytical fracture high-conductivity location diagnostic method for vertically fractured wells in multilayered reservoirs (Zhang s et al.).

In Chen's study (Chen), the adsorption and desorption properties of several organic refrigerants, e.g., R1234yf, R134a, R32, and their mixtures in metal-organic framework materials MOF-5 and Co-MOF-74 are investigated via molecular dynamics methods. Molecular dynamics simulations are conducted to investigate the desorption and regeneration behaviors of the organic working fluids within the MOFs. This work aims to provide useful insight in adsorption refrigeration.

In Jiang's study (Jiang et al.), a comparative study of thermally integrated pumped thermal energy storage based on the organic Rankine cycle with different working fluid pairs was carried out to identify the best working fluid pair according to the optimization results. This study also finds that the system's power-to-power efficiency of using different working fluids in either heat pump cycles or ORC cycles is lower than that of using the same working fluid throughout the entire system.

In Zhang's study (Zhang et al.), a CFD numerical simulation of particle deposition characteristics in automobile tailpipe was employed to calculate the airflow flow field and the discrete phase model (DPM) was used to simulate the particle phase motion. This work can provide theoretical guidance for the design of exhaust pipes, it also is expected to realize the goal of alleviating regional air pollution.

In Zhang's paper (Zhang et al.), a semi-analytical fracture high-conductivity location diagnostic method for vertically fractured wells in multilayered reservoirs is provided, which contributes to a deeper understanding of the potential of pressure data in characterizing multilayered reservoirs.

3 Disscussion

This Research Topic explores the significance of thermodynamic properties of functional fluids in energy utilization and new innovations of energy utilization systems, focusing on key concepts, applications, and future directions.

The applications in energy systems are significant. Energy utilization systems encompass a broad array of technologies and practices aimed at efficiently harnessing and distributing energy for various purposes. From electricity generation to transportation and industrial processes, these systems are integral to sustaining economic activities and improving quality of life. This essay explores the components, challenges, and future prospects of energy utilization systems.

In energy storage and conversion system, advanced energy storage technologies such as pumped hydro, compressed air energy storage (CAES), and thermal energy storage (TES) utilize functional fluids to store and convert energy efficiently. The selection of fluids with appropriate thermodynamic properties is crucial for maximizing energy storage density and minimizing energy losses.

There are also many challenges and future directions for the Research Topic. Several challenges confront energy utilization systems, reflecting both technical and societal complexities. Energy efficiency remains a significant concern, as inefficient processes lead to unnecessary waste and environmental impact. Improving efficiency through better technology and practices is essential for sustainable development. Environmental impact is another critical issue. Many energy utilization methods, particularly those reliant on fossil fuels, contribute to air pollution, greenhouse gas emissions, and climate change. Transitioning towards cleaner energy sources and reducing carbon footprints are pressing global imperatives. Infrastructure development poses challenges as well, particularly in regions with outdated or insufficient energy grids. Upgrading infrastructure to handle new technologies like renewable energy sources and electric vehicles is costly and requires careful planning and investment.

The future of energy utilization systems is promising yet complex. Renewable energy sources such as solar, wind, and hydroelectric power are increasingly becoming economically viable alternatives to traditional fossil fuels. Advances in energy storage technologies, such as batteries and grid-scale storage solutions, are crucial for managing intermittent renewable sources and enhancing grid stability. Energy conservation through policies, incentives, and behavioral changes also plays a pivotal role. Promoting energy-efficient practices in buildings, industries, and transportation can significantly reduce overall energy demand and environmental impact.

Moreover, innovations in energy utilization continue to drive progress. From advanced materials for more efficient solar panels to novel approaches in energy management and optimization, ongoing research and development are essential for tackling energy challenges effectively.

4 Conclusion

In conclusion, energy utilization systems are foundational to modern civilization, facilitating economic growth, technological advancement, and societal wellbeing. However, they also face significant challenges related to efficiency, environmental impact and infrastructure development. The future of these systems hinges on embracing renewable energy, enhancing energy efficiency, and adopting smart technologies. By addressing these challenges through innovation, policy, and global cooperation, societies can create a sustainable energy future that meets the needs of current and future generations while safeguarding the planet.

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