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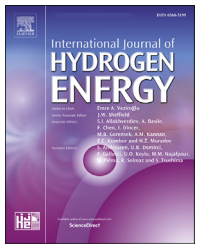

Characteristics of NH_3/H_2 blend as carbon-free fuels: A review

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HIGHLIGHTS

- Ammonia/hydrogen blends as carbon-free fuels have been reviewed.
- H_2 is an ideal promoter for improving NH_3 combustion.
- Effects of NO_x formation and Low- NO_x strategies are discussed.
- Combining two-stage combustion and humidified operation could achieve greater NO reduction.
- Challenges of NH_3/H_2 combustion have been discussed.

ARTICLE INFO

Article history:
Received 23 June 2022
Received in revised form
1 September 2022
Accepted 9 September 2022
Available online 8 October 2022

Keywords:
NH_3/H_2 blend fuel
NH_3 fuel
Hydrogen fuel
Low NO_x NH_3/H_2 combustion
Laminar flame speed

ABSTRACT

In the pursue of a carbon-free economy, the utilization of fuels with low or zero carbon footprint account for only 1% of global final energy demand, a share that is predicted to follow a dramatic growth to 20% by 2050. Ammonia (NH_3) has become dominant in the international transportation and storage of low-carbon alternative fuels. NH_3 is regarded as an alternative fuel, as a carbon-free fuel, and renewable hydrogen (H_2) carrier with high energy density, and its production and distribution infrastructure are well established. However, a current challenge is that NH_3 has a lower burning velocity and a narrow flammability limit. Thus, the use of NH_3 has numerous limitations in practical combustion applications. Blending NH_3 with H_2 is considered a solution that has been proposed to enhance NH_3 combustion by improving ignition, flammability, and H_2 safety issue. Using NH_3 blended with H_2 as a fuel in combustion systems is a practical approach to decarbonizing the energy sector.

Thus, this review highlights the existing influential studies and ongoing research on NH_3/H_2 blended fuels. The review covers NH_3 assists the safety behaviour of H_2 use, in-situ NH_3 dissociation, NH_3 and H_2 properties, NH_3/H_2 combustion characterization, techniques for low NO_x NH_3/H_2 combustion, and challenges for NH_3/H_2 combustion. Finally, recommendations for future studies are provided for further developing the utilization of NH_3/H_2 as blended fuel.

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https://doi.org/10.1016/j.ijhydene.2022.09.096