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C2Po1A-04: Optimizing nozzle-impeller coupling to enhance efficiency in hydrogen Turbo-Expanders

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Hydrogen energy, as a clean and efficient power source, plays a key role in the global energy transition. Hydrogen turbo-expanders, essential in liquid hydrogen production, significantly impact system performance. However, their efficiency is relatively low, primarily due to improper coupling between the nozzle and the impeller. This interaction greatly influences both efficiency and stability, and optimizing this coupling can lead to significant improvements. The study investigates the effects of nozzle-impeller coupling on turbo-expander efficiency, focusing on the flow characteristics between the nozzle outlet and impeller inlet, as well as the influence of the blade gap and attack angle. Results show that optimizing these factors reduces impact losses, minimizes vortex formation, and enhances energy conversion, leading to improved overall efficiency. The findings highlight the importance of nozzle-impeller coupling in enhancing hydrogen turbo-expander performance and provide valuable insights for future optimization efforts.

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