
Contribution ID: **179** Type: **Poster**

# C3Po1D-10: A novel nozzle design method for hydrogen Turbo-Expanders

*Wednesday 21 May 2025 09:15 (1h 45m)*

Hydrogen energy is a clean and efficient energy source with significant potential in the global energy transition. Liquid hydrogen, with its high energy density and ease of transport, is vital for large-scale liquefaction systems. Hydrogen turbo-expanders, as key components in this process, greatly influence efficiency and stability. However, the unique properties of hydrogen, such as low viscosity and high speed of sound, create challenges for turbo-expander design and optimization. To address these challenges, this work focuses on optimizing the nozzle blade profiles in hydrogen turbo-expanders. The interaction between the nozzle and impeller is critical yet challenging. Improper nozzle design can cause impact losses, uneven flow distribution, and increased secondary flows, reducing efficiency and stability. High flow velocities can also lead to transonic flows and aerodynamic disturbances, further impacting performance. Through computational simulations and refined design approaches, the optimized nozzles enhance flow quality, reduce losses, and strengthen nozzle-impeller coupling, significantly improving turbo-expander efficiency and operational stability. These findings provide valuable guidance for hydrogen turbo-expander optimization and support the efficient operation of hydrogen liquefaction systems.

**Author:** Mr LIU, Hongmin (Technical Institute of Physics and Chemistry, CAS)

**Co-authors:** LI, Kongrong (Technical Institute of Physics and Chemistry); KE, Changlei (Technical Institute of Physics and Chemistry); ZHANG, Xiaohua (Technical Institute of Physics and Chemistry); PENG, Nan (Technical Institute of Physics and Chemistry); Prof. LIU, Liqiang (Technical Institute of Physics and Chemistry); QIU, Shun (Technical institute of physics and Chemistry, CAS); LIANG, Yanwei (Technical institute of physics and Chemistry, CAS); ZUO, Jiansheng (Technical institute of physics and Chemistry, CAS)

**Presenters:** KE, Changlei (Technical Institute of Physics and Chemistry); Mr LIU, Hongmin (Technical Institute of Physics and Chemistry, CAS)

**Session Classification:** C3Po1D - Liquid Hydrogen Transfer Components