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C1Po3D-08: A review of the technology practice and future opportunities of liquid hydrogen centrifugal pumps

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Liquid hydrogen centrifugal pumps play a crucial role in the large-scale transport and utilization of liquid hydrogen as a kind of energy-transporting device with a wide range of application prospects. However, the liquid's motion within the pump is quite complex, making it challenging to fully determine the properties of the pump and the parameters of the fluid using only analytical methods. Consequently, the ongoing advancement of pump design methodologies and experimental testing techniques is imperative with the consideration of the intrinsic properties of the working mass, as well as the phenomenon of liquid vaporization, to facilitate the effective utilization of liquid hydrogen pumps in practical applications. This paper reviews the current state of development for liquid hydrogen centrifugal pumps and their technological approaches based on the parameter considerations and optimization. The difficulties associated with cavitation and lubrication during the design, simulation, testing, and application of liquid hydrogen pumps are highlighted. In addition, corresponding recommendations for addressing these issues are discussed. By utilizing high-temperature superconductor coils and superconducting magnetic levitation bearings as examples, the research also reflects the potential creation of liquid hydrogen pumps in conjunction with this technology.

Author: LI, Xinran (Technical Institute of Physics and Chemistry CAS)

Co-authors: LV, Cui (Technical Institute of Physics and Chemistry CAS); Prof. WU, Jihao; SHANG, Jin; LI, Yicheng (Technical Institute of Physics and Chemistry CAS)

Presenter: Prof. WU, Jihao

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