

Experimental Investigation of Continuous Ortho-Para Hydrogen Conversion for Hydrogen Liquefaction within the Range of 40-80 K

Thursday 25 July 2024 11:30 (15 minutes)

Ortho-para hydrogen catalytic conversion stands as a pivotal process in hydrogen liquefaction. Continuous conversion, the most energy-efficient, is realized by placing catalysts inside channels of heat exchangers. Experimental data is significant to reveal the underlying mechanism of thermal-flow-conversion process and optimize the conversion process, which is still lacking in the accessible literatures. In this investigation, a cryogenic experimental platform for heat exchangers with ortho-para hydrogen conversion is constructed where ortho-para hydrogen conversion coupled with heat transfer and flow is measured. The GM-cryocoolers are utilized as the cold source and helium acts as the refrigerant in heat exchangers tested. The hydrogen can be cooled to an impressive 36 K at an operating pressure of 2 MPa, sustained by a mass flow rate of 1 g/s (equivalent to 3.6 kg/h). A set of crossover tests are carried out regarding the heat exchanger parameters, the catalyst parameters, and the operating state of the fluids, and experimental correlations the catalyst-filled heat exchanger are proposed by measuring parameters such as temperature, pressure, flow rate, and para-hydrogen concentration. Furthermore, the mechanisms of flow and heat transfer coupled with catalytic conversion are elucidated. This study provides technical support for the design of continuous conversion heat exchangers.

Submitters Country

China

Authors: TENG, Junjie (Zhejiang University); Mr WEI, Xinyu (Zhejiang University); Ms WANG, Jinglei (Zhejiang University); Dr ZHU, Shaolong (Zhejiang University); Dr FANG, Song (Zhejiang University); Prof. ZHI, Xiaoqin (Zhejiang University); Prof. QIU, Limin (Zhejiang University); Prof. WANG, Kai (Zhejiang University)

Presenter: TENG, Junjie (Zhejiang University)

Session Classification: Thu-Or17

Track Classification: Tracks ICEC 29 Geneva 2024: ICEC 06: Cryogenic applications: hydrogen and LNG systems