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C1Or3B-05: Experimental study on the temperature distribution characteristics of gas-liquid two-phase flow in the cold energy storage packed bed

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With the development and application of cryogenic science, cold energy storage (CES) has widespread applications in industry. Solid-phase packed bed is a promising medium for CES due to its simple structure, low cost, and low risk of flammability and explosion. However, most of the previous studies have primarily focused on the sensible heat storage characteristics of single-phase flow inside the packed bed. In this paper, a latent heat storage solid-phase packed bed for CES is proposed. The basic principle is that the cryogenic liquid nitrogen enters the packed bed directly to store cold energy in the CES process, and the pressurized nitrogen obtains cold energy and is liquefied in the cold energy release process. The temperature distribution of the gas-liquid two-phase flow through the packed bed is investigated experimentally, and its thermocline and inlet/outlet temperature are analyzed. The results demonstrate that the temperature distribution of the packed bed is different from previous studies due to the phase change, especially in the cold energy release process, where there is a change from the pure liquid phase to the gas-liquid two-phase to the pure gas phase at the outlet. The conclusions obtained from the study can provide valuable insights into the design of latent heat storage packed beds for CES.

Author: FAN, Xiaoyu (Chinese Academy of Sciences Key Laboratory of Cryogenics, Technical Institute of Physics and Chemistry)

Co-authors: GAO, Zhaozhao (Chinese Academy of Sciences Key Laboratory of Cryogenics, Technical Institute of Physics and Chemistry); YANG, Biao (Chinese Academy of Sciences Key Laboratory of Cryogenics, Technical Institute of Physics and Chemistry); JI, Wei (Chinese Academy of Sciences Key Laboratory of Cryogenics, Technical Institute of Physics and Chemistry); CHEN, Liubiao (Chinese Academy of Sciences Key Laboratory of Cryogenics, Technical Institute of Physics and Chemistry); WANG, Junjie (Chinese Academy of Sciences Key Laboratory of Cryogenics, Technical Institute of Physics and Chemistry)

Presenter: FAN, Xiaoyu (Chinese Academy of Sciences Key Laboratory of Cryogenics, Technical Institute of Physics and Chemistry)

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