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Influence of enthalpy of the cryogenes on the evaporation rate test of the cryogenic vessel

Evaporation rate is an important technological parameter to evaluate the performance of a multilayer cryogenic vessel, especially for storing liquid hydrogen due to the low boiling point of the hydrogen. When the nitrogen is used to as the test fluid to evaluate the evaporation rate of the multilayer liquid hydrogen vessel especially for the larger volume vessel which can not directly use the liquid hydrogen to test the vessel the special thermodynamic property of the hydrogen must be considered. Considering the difference between the thermodynamic properties of the nitrogen and hydrogen the influence of the temperature difference of the heat transfer, properties of the material of the vessel at low temperature and the temperature distribution of the gas space in the vessel on the evaporation rate test method are discussed. Based on the theoretical analysis the difference of enthalpy of nitrogen and hydrogen of the gas phase inside the vessel is found to be the most important influence factor to be considered in developing the evaporation rate test method of the multilayer liquid vessel when the nitrogen is used to be as the test fluid. Finally the correlation of the evaporation rate of multilayer liquid hydrogen vessel to the test result using liquid nitrogen as test fluid is obtained and is compared to the evaporation rate experiment results of two liquid hydrogen vessel.

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