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Thermal Analysis and Investigations on Design Aspects of Aluminum alloy based Liquid Helium Dewar

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Content :

Dewar vessels for storage of cryogenic liquids are most commonly used in various industrial and research applications. Presently, Dewar vessels are fabricated mostly using stainless steel. However, there are inherent associated limitations such as increased weight and heat wastage in initial phase of cooling. Aluminum serves as one of the prominent candidates for replacement.

The present work deals with the thermal analysis and investigations of design aspects of aluminum alloy based liquid helium Dewar. It involves the estimation of heat in-leaks through the neck tube by apparent solid conduction, fluid conduction associated with the solid neck columns, and heat in-leak from the multi-shield super insulation. Numerical approach is employed by applying energy balance equations and the computer program is developed using Scilab® 5.5.2. The mechanical design aspects are investigated by using ASME boilers and pressure vessel code Section II, VIII Division-1. The work also includes the design of the inner and outer vessels by applying mechanical design constraints. Further, the shield positions along the neck of the Dewar are analysed by applying the thermal design approach.

Primary authors : Mr. ANDHALE, VILAS (Veermata Jijabai Technological Institute, India)

Co-authors : Dr. TENDOLKAR, Mandar (Veermata Jijabai Technological Institute, India) ; Mr. SRINIVASAN, K V (Tata Institute of Fundamental research, India) ; Prof. KULKARNI, Swati (Veermata Jijabai Technological Institute, India)

Presenter : Mr. ANDHALE, VILAS (Veermata Jijabai Technological Institute, India)

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