26th National Symposium on Cryogenics and Superconductivity

Contribution ID : 54

Structural and Thermal analysis of dewar supports for low boil-off long duration storage of cryogenic liquids

Content :

Design of a cryogenic liquid-storage system for various applications is unique and hence, is still an evolving field of research and development as newer applications of cryogens are being envisaged. The conventional way of storing cryogenic liquid is the use of dewars, which are double walled containers using evacuated insulation materials to reduce heat in leak from the ambient. For large scale applications, the inner and outer walls of the dewar are held together with the help of an elaborate support system, having high mechanical strength and low thermal conductivity. Design of the dewar support system to store and transport cryogenic liquids on a mobile platform poses considerable challenge. Some studies have been carried out by NASA in regard to the development of support systems for LOX and LH2 tanks for cryogenic systems. However, such designs are limited to comparatively lower stresses and for short storage durations. The present study lays the foundation for addressing a long duration storage of cryogenic liquid under very high-stress levels. The study involves the evaluation of the structural and thermal performances of such vessels in order to ensure structural stability of the vessel while allowing minimal boil off loss of the stored cryogenic fluid. A FEM based numerical study is underway to compare a few possible support (suspension) systems in terms of the structural and thermal stresses, and heat inleak to the cryogen liquid from the ambient.

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Session classification : Poster Session 2: Abstract ID 11,33,34,35,36,38,39,40,43,48,52,54,59,66, 67,70,71,78,88,89,90,92,94,100,102,105,107,108, 109,111,112,115,116, 120,121,124,125,127,128,129,131,190

Track classification : Heat Transfer / Thermal Insulation / Thermal Analysis

Type : --not specified--