Contribution ID: **455** Type: **Poster Presentation (120m)**

Numerical modelling of tank motion on heat and mass transfer in liquid hydrogen storage

Tuesday 23 July 2024 14:00 (2 hours)

The rate of self-pressurization in partially filled cryogenic tanks is dependent on vapour-liquid heat transfer and the ability of the liquid to transfer heat from the surface. This heat transfer may be enhanced by tank motion, such as during transport, which can lead to different pressurisation profiles depending on the mode of liquid sloshing within the tank. In pressurized liquid hydrogen fuel tanks, sloshing may cause a drop in vapour pressure and affect the fuel flow. During the transport of liquid hydrogen, this may extend the period of lossless storage but affect the subsequent rate of boil-off. Existing studies in this area have included empirical correlations for heat transfer based on lab-scale tank data [1]. This study aims to extend this work by investigating the effect of lateral and rotational motion in partially filled pressurized tanks. A CFD model was developed in ANSYS FLUENT and was validated against experimental data for a spherical tank. A parametric investigation was conducted across a range of sizes and fill levels. The effect of baffles as a method for reducing pressure drop was also investigated. Limitations of the VOF method for multiphase flow and interface capturing were encountered and will be discussed.

1. Ludwig, C., M.E. Dreyer, and E.J. Hopfinger, Pressure variations in a cryogenic liquid storage tank subjected to periodic excitations. International Journal of Heat and Mass Transfer, 2013. 66: p. 223-234.

Submitters Country

Australia

Author: WANG, James (Monash University)

Co-authors: Prof. WEBLEY, Paul A. (Monash University); HUGHES, Tom J. (Monash University)

Presenter: WANG, James (Monash University)

Session Classification: Tue-Po-1.6

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