Novel Vacuum Insulation Concepts for Large-Scale Liquid Hydrogen Storage

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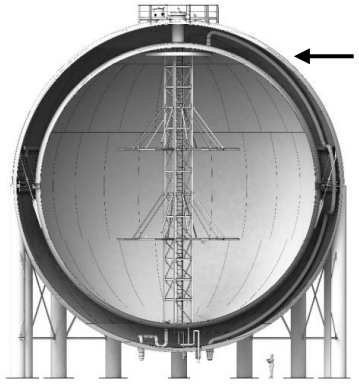
Related project: Novel Insulation Concepts For Liquefied Hydrogen Storage Tanks (NICOLHy)

I am a PhD student at NTNU Mechanical and Industrial Engineering Department studying the thermomechanical behavior of novel vacuum insulation concepts for large-scale liquid hydrogen storage. My research focuses on thermally induced deformations and coupled temperature-displacement effects in multi-material assemblies at -253°C. I use Abaqus/Ansys for simulations, SolidWorks/NX for CAD, and Python for automation.

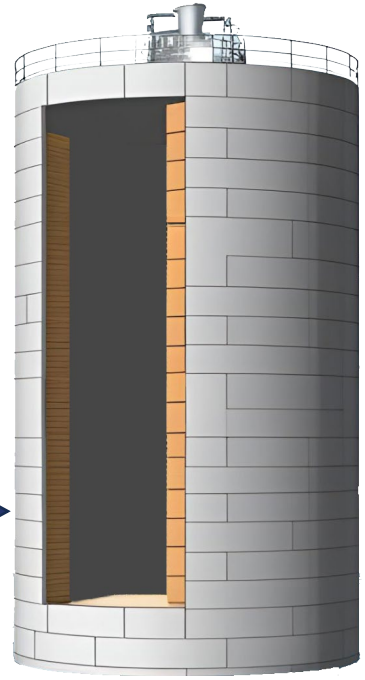
Introduction

Cryogenic storage of liquid hydrogen (-253°C) presents significant challenges due to extreme temperature differences, leading to thermal deformations and mechanical stresses. Traditional insulation solutions struggle to balance thermal efficiency, mechanical integrity, and manufacturability. This project investigates novel vacuum insulation concepts for large-scale liquid hydrogen storage assessing their potential.



State-of-the-art ≈ 4,700 m^3

[1] J.Fesmire 2021



Volume Targets: 40,000 m^3 - 200,000 m^3

[1] doi:10.1088/1757-899X/1240/1/012088

Primary objective

Evaluate the thermomechanical performance of novel vacuum insulation concepts under cryogenic conditions.

Secondary objectives

- Optimize material and structural performance.
- Develop a simulation framework to simulate real-world cryogenic conditions.
- Ensure practical feasibility.

Estimated progress of the PhD project:

Just started ...	< 50 %	> 50 %	Almost done ☺

Publications

www.nicolhy.net/Resources/Publications/

Norwegian Research School on Hydrogen and Hydrogen-Based Fuels

NTNU Norwegian University of Science and Technology

NICOLHy

Clean Hydrogen Partnership

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