

# 26th National Symposium on Cryogenics and Superconductivity

Contribution ID : 28

## Cryogenic chill down phenomena in horizontal tube with liquid nitrogen

### Content :

Cryogenic fluid find its applications in several area and cryogenic propulsion is one of them. Chill down of the piping systems and propellant tanks during filling of propellants, i.e. liquid hydrogen and liquid oxygen, before the launch and chill down of the engine and its piping before the start of the engine, is a crucial part of launch sequence and propulsion system. The chill down ensures single phase transfer of propellants and an efficient chill down also optimizes the propellant quantity. In order to study the transient effect of chill down phenomenon, an experimental setup is developed at IIT Bombay, where liquid nitrogen is used as a cryogen. Experiments are carried out using a stainless steel tube. Surface temperatures of the tube are measured at different axial locations as well as in azimuthal planes. Experiments are conducted at different pressures and mass flow rates to understand their effects on chill down phenomena. Using the measured temperature history, various parameters like inner wall surface temperature, rewetting temperature, total heat flux, critical heat flux and heat transfer coefficients are calculated for different pressures and mass flow rates. Measured temperature history and heat flux plots show the occurrence of three distinct regimes of pool boiling, i.e. film boiling, transition boiling and nucleate boiling. The study also highlights the relationship between the chill-down time and heat transfer coefficients as a function of mass flux for each flow regime.

Primary authors : Mr. SHUKLA, Ashish (Indian Space Research Organisation and Indian Institute of Technology Bombay)

Co-authors : Mr. SRIDHARAN, Arunkumar (Indian Institute of Technology Bombay) ; Mr. ATREY, Milind (Indian Institute of Technology Bombay)

Presenter : Mr. SHUKLA, Ashish (Indian Space Research Organisation and Indian Institute of Technology Bombay)

Session classification : Poster Session 1: Abstract ID

1,2,3,8,9,15,16,21,23,25,27,28,29,30,42,44,46,47,49,50,51,58,61,65,79,81,82,87,96,97,98,106,126,130,189

Track classification : Cryogenics Storage and transfer lines / Space Research / Cryogenic Test & Test  
Facilities

Type : --not specified--