Announcing the Final Examination of Akshay Khadse for the degree of Doctor of Philosophy

Time & Location: March 26, 2020 at 10:30 AM in Engineering 1 288
Title: SUPERCRITICAL CO2 HEAT TRANSFER STUDY NEAR CRITICAL POINT IN A HEATED CIRCULAR TUBE

Supercritical CO2 (sCO2) can be utilized as a working fluid in various systems including high scale power cycle, portable power production unit, centralized cooling system and stand-alone cooling device. Lack of accurate predication tools such as heat transfer coefficient correlations and insufficient knowledge behind fundamental heat transfer processes can hinder its practical realization in key energy and cooling systems. The overall objective of the study is to extend fundamental knowledge about heat transfer and fluid flow processes in conduits pertinent to sCO2 power cycle. The emphasis here is investigation of heat transfer effects of three testing parameters: heat flux, inlet mass flux and inlet temperature. Richardson number and Jackson parameters are calculated to study buoyancy effects. The test section is stainless steel tubing of inner diameter of 9.4 mm and heated length of 1.23 m with uniform volumetric heat generation within tubing walls. The designed test apparatus and data reduction process are validated with high pressure air experiments. Nusselt numbers are calculated at top, bottom and sidewall locations to present effects of buoyancy. Enhancement of heat transfer at bottom wall surfaces and deterioration at top wall surfaces is observed as the main effect of buoyancy in case of horizontal flows. Heat transfer behavior is also affected by ratio of bulk flow temperature to pseudocritical temperature whether the ratio is <1 or >1. Need for new buoyancy parameters for better estimation of heat flux and mass flux effect is also discussed here.

Major: Mechanical Engineering

Educational Career:
Bachelor's of Aerospace Engineering, BS, 2015, Indian Institute of Technology, Bombay
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Committee in Charge:
Jayanta Kapat, Chair, Mechanical & Aerospace Engineering
Subith Vasu, University of Central Florida
Jihua Gou, University of Central Florida
Richard Blair, Florida Space Institute

Approved for distribution by Jayanta Kapat, Committee Chair, on March 12, 2020.

The public is welcome to attend.