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Investigating the Impact of Variable Properties for Cryogenic Helium in a Heat Transfer in a Microchannel[1] CHOAH SHIN, Oregon State University, MICHAEL MARTIN, SHASHANK YELLAPANTULA, MARC HENRY DE FRAHAN, RAY GROUT, National Renewable Energy Laboratory — Cryogenic helium in liquid, vapor, and supercritical phases is used for cooling in a range of applications, including quantum computers, superconducting magnets, and infrared sensors used in astronomical measurements. Properties such as density, viscosity, thermal conductivity, and specific heat vary significantly near the critical point (5.2 K and 227.46 kPa). We have simulated laminar flow in a heated square microchannel with widths ranging from 25 to 100 microns under supercritical conditions. We perform the simulations using *PeleC*, a computational fluid dynamics code with adaptive mesh refinement, embedded boundaries, and complex fluid equations of state. At temperatures between 30 and 60 K, the Soave-Redlich-Kwong equation of state is used to calculate thermodynamic properties. A temperature and pressure sensitive model is also used for transport properties. As the temperature changes due to wall heating, we observe the variations of properties in the fluid due to these models, and measure the impact on flow structure and channel heat transfer.

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