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Two phase flow of helium in single nanopipes ANGEL VELASCO, CRYSTAL YANG, ZUZANNA SIWY, University of California, Irvine, M.E. TOIMIL-MOLARES, GSI Helmholtzzentrum fur Schwerionenforschung GmbH, PETER TABOREK, University of California, Irvine — We report measurements of pressure driven flow of liquid helium entering vacuum through a single pipe of nanometer scale diameter. Nanopores were fabricated by etching a single ion track in either PET or mica. A calibrated mass spectrometer was used to measure the flow rates of liquid helium through pipes with diameter ranging from 80 nm to 31 nm. The liquid evaporates inside or near the exit of the nanopipe. The flow of helium was studied from 0.5 K to the lambda point (2.18 K) and from the lambda point to above the critical point (5.2 K). Flow rates were controlled by changing the pressure drop across the pipe in the range 0-5 Atm. When the pressure in the pipe reached the saturated vapor pressure, an abrupt flow transition was observed. For normal helium a viscous flow model accounting for interfacial forces is used to determine its position inside the pipe [1]. The observed mass flow rates are consistent with no slip boundary conditions. In superfluid the flow is essentially independent of the pressure drop with a maximum critical velocity of 11 m/s. The critical velocity has temperature dependence consistent with the homogeneous nucleation of vortices.

[1] A. E. Velasco, C. Yang, Z. S. Siwy, M. E. Toimil-Molares, and P. Taborek, Applied Physics Letters **105** (2014)

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