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Superfluidity and Capillary Condensation in Porous Materials
R.J. LAZAROWICH, P. TABOREK, J.E. RUTLEDGE, Low Temperature Laboratory, University of California, Irvine, Department of Physics — We have studied superfluid onset and capillary condensation in liquid helium in porous gold using the quartz crystal microbalance (QCM) technique. Au/Ag alloy films were sputtered onto QCM surfaces, and used to form porous gold substrates of various thicknesses and pore size. Helium isotherms on these samples show that at low temperature where the superfluid transition occurs prior to capillary condensation, superfluid onset has the conventional features of a KT transition, including mass decoupling and dissipation. At higher temperatures, the superfluid transition occurs within the capillary condensation hysteresis region where the film thickness is a multivalued function of the chemical potential. In this regime, the only signature of superfluid onset is a peak in the dissipation; there is no discernable mass unloading. This behavior persists even at temperatures near Tlambda, where onset occurs when the pores are full of liquid. To determine how universal this behavior is, we have attempted to make a porous material with uniform pore size by electrochemical anodization of aluminum films on a QCM. We will present preliminary isotherms on these porous alumina films.

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