Mass Flux through Solid ^{4}He Induced by Chemical Potential Differences

R.B. Hallock

Laboratory for Low Temperature Physics, Department of Physics, University of Massachusetts, Amherst, MA, 01003, USA

We the thermo-mechanical effect (and also direct mass injection) to create chemical potential differences between two superfluid-filled reservoirs connected to each other through Vycor rods in series with solid hcp ^{4}He. We determine that an increasing DC flux of atoms takes place through the solid-filled cell with decreasing temperature below $\approx$ 600 mK. That flux falls abruptly in the vicinity of 80 mK, but increases again at lower temperatures[1]. These experiments will be reviewed as will our studies of the growth of solid ^{4}He where it is seen that it is impossible to add density to a solid freshly made at 60 mK and samples freshly made near 60 mK do not allow mass flux, even when raised in temperature to 200 mK. Solids created above $\approx$ 300 mK and cooled to 60 mK accept added density and demonstrate finite mass flux. Relationships to theoretical work and other solid helium work will be discussed.

[1]Phys. Rev. Letters 100, 235301 (2008); 105, 145301 (2010). All work done in collaboration with Michael Ray who is now at UC Berkeley. Supported by NSF DMR 08-55594.

INVITED PAPER