Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Probing the $^3$He distribution in coexisting liquid and solid $^4$He$^1$
ZHIGANG CHENG, JOHN BEAMISH, University of Alberta — Substantial attention has been focused on recent experiments of $^4$He mass flow across solid-liquid interfaces and within completely solid samples. The flow is suppressed by $^3$He impurities and appears to involve superfluid pathways: microscopically thin superfluid layers, dislocations with superfluid cores allowing superclimb, or both. It is clear that $^3$He accumulates in the liquid $^4$He and on solid-liquid interfaces, depleting the $^3$He concentration in the solid at low temperature. Here we report a preliminary study of the $^3$He concentration in the liquid phase of solid-liquid coexisting samples. By measuring the capacitance between two concentric cylinders immersed in the liquid helium, we are able to detect movement of $^3$He between the solid and liquid phases, thanks to the dependence of the dielectric constant on $^3$He concentration. We measure the migration of $^3$He into the liquid at low temperatures and find that the time constant for the concentrations to equilibrate is longer at lower temperature.

$^1$This project is supported by NSERC, Canada

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Date submitted: 11 Nov 2016

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