Suppression of KT transition in ^{4}He film under high pressure ^{3}He

S. Murakawa, M. Wasai, K. Akiyama, R. Nomura, and Y. Okuda

Department of Physics, Tokyo Institute of Technology, Tokyo, Japan

We observed a superfluid transition of ^{4}He films under high pressure liquid ^{3}He by the transverse acoustic measurements of AC-cut quartz transducers. ^{4}He was first adsorbed on the transducer and thereafter ^{3}He was introduced to pressurize the ^{4}He film. Superfluidity was detected as an enhancement of surface specularity which is calculated from the transverse acoustic impedance.
The specularity is not constant but has a large temperature dependence: the specularity is zero at high temperature and begins to increase below an onset temperature T_0. The frequency dependence of T_0 is well explained by the dynamic KT model. Specularity in the low temperature limit has a linear dependence on ^{4}He thickness as the superfluid density has the linear dependence in KT transition of the pure ^{4}He film[1]. From these frequency and thickness dependences, we can conclude that the enhanced specularity is due to the KT transition of the ^{4}He film.
T_0 is strongly suppressed at higher pressures although ^{4}He film is thick enough. Because transition temperature was much higher in ^{4}He-^{3}He mixture film experiments[2] than T_0, the observed suppression is caused not only by the ^{3}He impurity effect but also by the strong particle correlation at high pressures.

[1]D. J. Bishop and J. D. Reppy, Phys. Rev. B **22**, 5171 (1980).
[2]D. McQueeney and G. Agnolet and J. D. Reppy, Phys. Rev. Lett. **52**, 1325 (1984).