

Abstract Submitted
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Torsional Oscillator Study of Gap-Induced Elasticity of ^4He Films on Disordered Substrate¹ TAKAHIKO MAKIUCHI, MICHIHIRO TAGAI, YUSUKE NAGO, KEIYA SHIRAHAMA, Department of Physics, Keio University, Japan — We report torsional oscillator (TO) studies of the superfluid-insulator transition in ^4He films adsorbed on disordered substrate. ^4He films are superfluid above a critical coverage n_c . Below n_c , an energy gap opens between two distinct states of adatoms; the localized (insulating) state, in which the adatoms are bound to the substrate, and the extended state, in which they can move freely. Previous TO measurements in which a porous Gelsil glass was located in the torsion bob showed an anomalous response at lower temperature in the insulating phase. This was interpreted as a stiffening of ^4He film. To measure directly the elasticity, we have begun a new TO study. The TO has a Gelsil glass torsion rod and a dummy bob. We have clearly observed a change in the resonant frequency and an energy dissipation peak, which are originated from a change in shear modulus of adsorbed He film. The temperature dependence of the resonant frequency and the dissipation agrees well with those in the previous TOs at the same coverage. Results definitely conclude a crossover between “stiff” and “soft” states of ^4He films governed by a coverage dependent energy gap in the insulating phase.

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