Competition between superfluid overlayer and mobile solid layer of ^{3}He-^{4}He mixture films on porous gold

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In the previous QCM measurements for ^{4}He films adsorbed on porous gold, we have observed a competition between superfluidity and slippage: In relative low areal densities, the resonance frequency increases gradually below a certain temperature T_S due to the slippage of solid layer, while the superfluid onset T_C is observed in high areal densities. In the crossover region, the slippage below T_S is suddenly suppressed at a certain temperature T_D, which is just below T_C. As an origin of this sudden suppression, the hardening of a new sound mode has been suggested, where a superfluid component oscillates with a normal component bound to dislocations in solid layer in an out-of-phase way.[1] To change the amount of normal component, we introduced a small amount of ^{3}He onto ^{4}He films, and studied the competition as a function of ^{3}He areal density ρ_3. As ρ_3 is increased, T_C is monotonically suppressed. On the other hand, T_D increases in the low ρ_3 region, and then turns over to decrease in parallel to T_C. We will discuss the ρ_3 dependence based on the new sound mode.

1. T. Minoguchi, J. Phys.: Conf. Ser. **150** 032060 (2009).

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