Superfluidity of ^{4}He confined in a nanopore array probed by a vibrating wire

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Recent experiments have revealed that superfluidity of ^{4}He confined in some nanoporous materials is strongly suppressed under pressure[1]. Since the pore sizes of the materials, which span between 2 and 3 nm, are much larger than the superfluid coherence length ($\sim$ 0.3nm), the experiments imply a new suppression mechanism by strong correlation between ^{4}He atoms inside the nanopores. Another intriguing possibility is to utilize the suppression phenomenon to realize a superfluid weak link. Here we report on the measurement of the superfluid transition of ^{4}He in a regular array of nanopores made of porous alumina (PA). We employ vibrating wire technique, in which a PA flake is glued to the point of a semicircular NbTi wire and is vibrated in superfluid ^{4}He at various pressures. In a preliminary measurement using PA with 45 nm diameter nanopores, we have observed superfluid transition inside the nanopores as abrupt changes in resonant frequency and linewidth of the composite wire oscillator. Further measurement using 10-nm nanopores is underway.

[1]K. Yamamoto *et al.*, Phys. Rev. Lett. **93**, 075302 (2004).; K. Yamamoto *et al.*, Phys. Rev. Lett. **100**, 195301 (2008).; J. Taniguchi *et al.*, Phys. Rev. B. **82**, 104509 (2010).