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Influence of Au layer on the morphology and superconductivity of the ultra-thin Pb film using Low-temperature STM/S SHENGYONG QIN, ALEXANDER KHAJETOORIANS, CHIH-KANG SHIH, University of Texas at Austin — Thin film superconductivity is a subject of great scientific importance. Recently by using epitaxial thin Pb films, two papers reported the observation of quantum oscillations of thickness-dependent superconductivity. By using ex situ transport measurements on Pb thin films grown on Si(111) substrate and subsequently covered with 2 ML of Au, Guo et al. reported Tc oscillation between 22 and 28 MLs and a rapid decrease of Tc below 20 ML. On the other hand, Eom et al., by using in situ tunneling spectroscopy to measure the superconducting gap directly, reported persistent quantum oscillations of superconductivity from 18 ML down to 5 ML without any sign of quenching. One explanation of such apparent inconsistency is the existence of the Au capping layer used in the ex-situ transport measurements. Here we explore the role of Au capping layer on superconductivity of Pb thin film directly using STM/S. We show that the Au capping layer induces significant roughening of the Pb thin films. Moreover, we found that the deposition of Au first induces the formation of AuPb alloy followed by Au overlayer. Direct measurement of superconducting gaps on the film at different stages of Au deposition are also performed. The details of how Au overlayer impact the superconductivity of thin Pb films will be presented.

Shengyong Qin
University of Texas at Austin

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