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Quantized Electronic Structure and Growth of Pb Films on Highly Oriented Pyrolytic Graphite YANG LIU, UIUC, JENS PAGGEL, Continental Automotive GmbH, MARY UPTON, Argonne National Lab, TOM MILLER, TAI CHIANG, UIUC, UNIVERSITY OF ILLINOIS, URBANA-CHAMPAIGN TEAM — We have measured the electronic structure of thin Pb films grown on highly oriented pyrolytic graphite (HOPG) by angle-resolved photoemission spectroscopy. Quantum well states (QWS) corresponding to confined Pb valence electrons are observed. Although the films are rough, the thickness distribution is sufficiently narrow to allow a unique assignment for each QWS peak in terms of a quantum number and the exact film thickness in atomic layers. The even film thicknesses are found to be much more prevalent than the odd film thicknesses. These results are consistent with an available first-principles calculation of the surface energies of freestanding films; an implication is that the interaction between the Pb film and the HOPG substrate is weak. The effective masses of QWS at the surface zone center agree well with the results calculated from the bulk Pb band structure, in sharp contrast to the strongly enhanced or anomalous effective masses in Pb films grown on Si(111) as reported previously. This finding indicates that the anomalous effective masses in Pb/Si(111) are not caused by increased electron correlation effects in a confined geometry, but rather attributable to a strong interfacial interaction between the QWS and the substrate electronic structure.

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