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Modification of the Quantum Electronic Stability of Thin Films by Interfactants T. MILLER, D. A. RICCI, M. H. UPTON, T.-C. CHIANG, Univ. of Illinois at Urbana-Champaign — Electronic states are quantized in thin films, resulting in a modulation of physical properties with film thickness. The thermal stabilities of films differing in thickness by even a single monolayer can be dramatically different due to this quantization. The spectrum of allowed energy states depends on the film thickness, but it is also dependent on the phase shift of the wavefunctions reflected from the film-substrate interface. This phase shift in turn can be adjusted by changing the interface using interfactant atoms. This implies that the physical properties of thin films, including the thermal stability, could be controlled by interfacial engineering. We have grown atomically-uniform thin films of Pb on Si(111). Their thermal stabilities show bilayer oscillations with thickness due to the quantization of electronic states. The stabilities are strongly modified by the introduction of Au, In, or Pb at the film/substrate interface. For example, with In as an interfactant, films an odd number of monolayers thick are more stable than ones with an even number of layers, whereas for the other materials this pattern is reversed.

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