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PROGRAM AND ABSTRACTS

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Filtered pulse cathodic arc deposition is a new film fabrication method. One of the merits is that the plasma transport efficacy can be controlled to produce a variety of thin films with different thicknesses. The thickness of the films prepared by this method can be varied from tens of nanometers to micrometers. However, because of plasma confinement in the curved duct that is frequently used to eliminate deleterious macro-particles and divergent diffusion of the plasma from the exit, the characteristics of the films are affected. In this work, parameters such as the magnetic field flux density, curved duct bias, and deposition temperature are investigated from the prospective of the thickness uniformity across the film. Under different conditions, the resulting films have different morphology and microstructures and the optimal parameters for proper film fabrication are discussed.

In metallic ultrathin films, these states influence the Density of States at the Fermi level and, thus, many properties (superconducting transition temperature, resistivity) of thin films depend on them. We have shown recently that for Pb/Cu(111) the contribution of these states to the total energy of the system determines its structural stability, which oscillates with the thickness, giving rise to islands with preferred or “magic” height.

Here, variable temperature STM is used to visualize the thermal evolution of Pb films deposited on Cu(111) at 60 K, a temperature low enough to allow the kinetically hindered initial growth of flat films of even forbidden thicknesses. Tunnelling Spectroscopy is used to determine the local thickness of Pb. This allows the quantitative determination of the temperature dependence of the population of the different atomic layer and the roughening temperature of each atomic height, which oscillates with bilayer periodicity and a longer beating period, as dictated by the Fermi surface of Pb. Conditions are found to stabilize, by this quantum effect, particular thicknesses up to room temperature, resulting in Pb films which are atomically flat over lateral distances of microns, limited only by the perfection of the substrate.

The magic height effect is employed to grow an atomically flat Pb film on a 50 micron-thick, ultra-perfect Si (111) wafer, which acts as an ideal mirror for He atoms. This "quantum mirror" will be used to focus a beam of He atom down to 100 nm and it is an essential part of the atom microscope with sub-micron spatial resolution currently under construction.