Oral Contributions

[MS14-02] Epitaxy on Quasicrystals: Rotational Epitaxy to Single Element Quasicrystalline Multilayers

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Since their discovery [1], quasicrystalline phases have been observed in more than 100 intermetallic compounds, liquid crystals [2], polymers [3] and colloids [4] and are recognized as universal phases of matter. Quasicrystals are materials with long-range order without periodicity and exhibit conventionally forbidden fivefold and tenfold rotational symmetry. Because of their unusual structure and rotational symmetry, we have used quasicrystals as templates for the exploration of new epitaxial phenomena. Several intriguing results have been observed in adsorption on surfaces of the Al-based quasicrystals [4]. These include pseudomorphic monolayers of Bi, Sb, Pb, and Sn, quasiperiodically modulated multilayer structures of Cu and Co, fivefold-twinned islands with magic heights influenced by quantum size effects and a non-fcc structure of Ag [5-8]. We have recently succeeded in growing multilayered quasicrystalline films of the single elements Pb, Bi and Sb on Ag-based quasicrystals (Fig 1), in contrast to all previous observations of modulated multilayers and quasicrystalline monolayers observed on the common Al-based quasicrystals. We will also show the formation quasicrystalline monolayer of molecules like pentacene on quasicrystals surfaces.Experimental methods used in these investigations include scanning tunnelling microscopy (STM), low energy electron diffraction (LEED), and x-ray photoemission spectroscopy (XPS). The experimental results are supported by density functional theory (DFT) calculations.

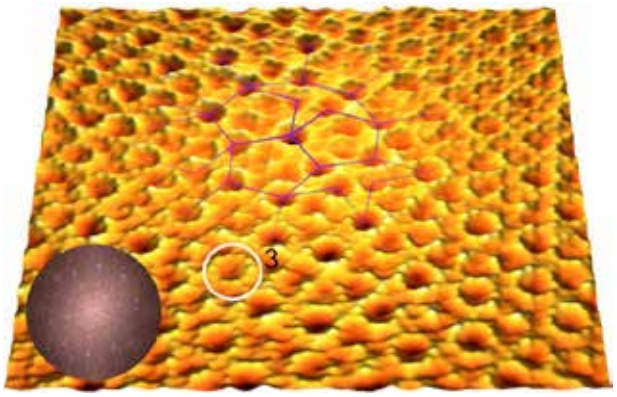

Fig 1: STM image (30 nm x 300 nm) of multilayer Pb film formed on the fivefold icosagedral Ag-In-Yb surface. The structure can be mapped by a Penrose tiling. A Pb decagon is marked by a circle. Inset shows the Fourier transform of the image confirming quasicrystalline long range order.

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