

Templated quasicrystals of single elements and molecules

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Quasicrystals exhibit long range order but without periodicity. Quasi-crystalline phases have been found in various materials from metallic alloys, polymers to oxides. Here we present our recent observations of templated quasicrystalline order of single elements (Pb, Bi and In) and molecules (pentacene and C_{60}) (Figure 1). Using scanning tunnelling microscopy (STM) and DFT calculations, we find that lead atoms deposited on the surfaces of icosahedral Ag-In-Yb quasicrystal occupy the positions of rhombic triacontahedral (RTH) cluster [1], which is the building block of the Ag-In-Yb quasicrystal. We also found that Pentacene molecules adsorb at tenfold-symmetric sites of Yb atoms around surface-bisected RTH clusters, yielding quasicrystalline order [2]. Similarly, C_{60} growth on the fivefold surface of *i*-Al-Cu-Fe at elevated temperature produces quasicrystalline layer, where the growth is mediated by Fe atoms on the surface [2]. Second part of the talk will focus on surface structure of quasicrystalline approximants, which were grown in Tokyo University of Science. The approximants develop facets along different crystallographic directions. Interestingly though, there are some common features in facets. We will show that the hybridization between electronic states of Ag/In and RE may play role for stability of the surfaces.

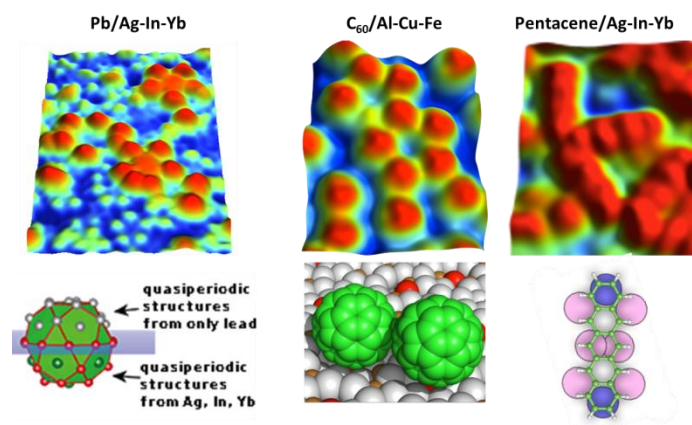


Figure 1: STM observation of quasicrystalline thin film of Pb, C₆₀ and Pentacene formed on the quasicrystal surfaces.

[1] H. R. Sharma, K. Nozawa, J. A. Smerdon, P.J. Nugent, I. McLeod, V. R. Dhanak, M. Shimoda, Y. Ishii, A.P. Tsai and R. McGrath, *Nature Communications* **4**, 2715 (2013).

[2] J. A. Smerdon, K. M. Young, M. Lowe, S. S. Hars, T. P. Yadav, D. Hesp, V. R. Dhanak, A. P. Tsai, H. R. Sharma and R. McGrath, *Templated quasicrystalline molecular ordering*, *Nano Letters* **14**, 1184 (2014)