MS26-01 | Some Recent Advances in the Surface Science of Complex Metallic Alloys

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Complex metallic alloys present unique challenges and opportunities in surface science, both for preparation of clean surfaces and for epitaxial studies.

Studies of three Ag-In-RE(100) (RE=Yb,Gd,Tb) approximants illustrate a variety of surface behaviours when prepared in ultra-high-vacuum conditions [1] from flat surfaces to multiple faceting; I will discuss the origin these behaviours in terms of surface atomic bonding.

In recent work, we demonstrated that C_{60} molecules adsorbed on this surface at room temperature form a Fibonacci square grid – the first physical manifestation of a prediction made in 2002 by Lifshitz [2]. In this case the C_{60} molecules bond preferentially to Mn atoms in the surface layer, which are arranged in the Fibonacci square grid geometry [2].

In a further study, the adsorption of Pb atoms on the 3-fold surface of the icosahedral Ag-In-Yb quasicrystal proceeds in an unusual way; instead of layer-by-layer growth as was observed on the five-fold surface [3], the atoms form quasicrystalline Pb nanoclusters by mimicking the structure of the underlying substrate. I will discuss whether this is long-sought evidence for "cluster stability" in quasicrystals.

[1] S. Hars, H. R. Sharma, J. A. Smerdon, T. P. Yadav, A. Al-Mahboob, J. Ledieu, V. Fournée, R. Tamura, and R. McGrath, Phys. Rev. B 93 (2016) 205428
[2] S. Coates, J.A. Smerdon, R. McGrath & H. R. Sharma, Nature Communications 9 (2018) 3435.
[3] S. Coates, S. Thorn, R. McGrath and H.R. Sharma, in preparation.