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Tenkých vrstev a nanostruktur

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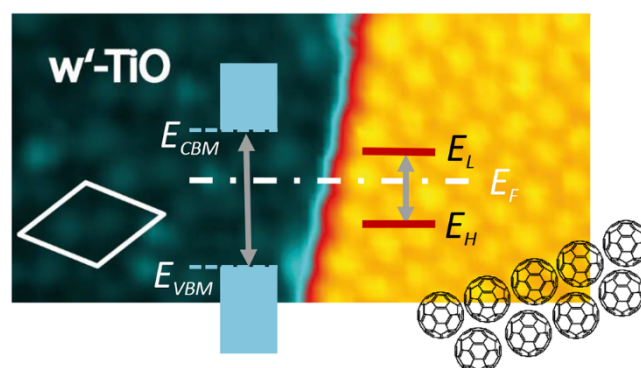
TÉMA

Buckminsterfullerene: a probe to reveal hidden surface properties of metals

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Close-packed monolayers of Buckminsterfullerene (C₆₀) on metallic substrates are very rich systems with respect to their rotational degrees of freedom and possible interactions with different adsorption sites or next neighbors. They have attracted much attention due to their structural and electronic properties. Here, we focus on the ability of C₆₀ to form self-assembled monolayers that mirror impressively the electronic properties of the respective substrate. Using low-temperature UHV-STM and STS in combination with DFT calculations the interactions of C₆₀ molecules with a metallic surface [1,2], an alloy [3], and a thin titanium oxide film [4] are characterized in detail. The LT-STM images with highly resolved orbital structure allow a detailed assignment of the C₆₀ adsorption orientation and geometry with respect to the underlying substrate. Moreover, even second order interface effects, that is, interactions of C₆₀ with atoms of the subsurface layer are identified [2]. Most interestingly, in the case of a Pt₃Ti-single crystal alloy [3] used as substrate the influence of subsurface Ti-atoms on the self-assembly behavior of fullerenes is determined [5]. Here, third layer Ti-atoms provoke an adsorption energy landscape of the single crystal alloy so that the C₆₀/alloy interfacial interactions result in the creation of a new C₆₀ monolayer structure. On the other hand, C₆₀ can be decoupled effectively from the Pt₃Ti alloy surface, if it is oxidized prior to the C₆₀ assembly [4] (see Figure).



[1] M. Paßens, R. Waser, S. Karthäuser, Beilstein J. Nanotechnol. 6, 1421-1431 (2015).

[2] M. Paßens, S. Karthäuser, Surf. Sci. 642, 11-15 (2015).

[3] M. Paßens, V. Caciuc, N. Atodiresei, M. Moors, S. Blügel, R. Waser, S. Karthäuser, Nanoscale 8, 13924-13933 (2016).

[4] M. Paßens, M. Moors, R. Waser, S. Karthäuser, J. Phys. Chem. C 121, 2815-2821 (2017).

[5] M. Paßens, V. Caciuc, N. Atodiresei, M. Feuerbacher, M. Moors, R. E. Dunin-Borkowski, S. Blügel, R. Waser, S. Karthäuser, Nat. Commun. (2017) DOI: 10.1038/NCOMMS15367.

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