

Rare earth modified silicon surfaces: A promising template for ordered organic growth

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The self-assembly of organic molecules into ordered layers on solid surfaces is of considerable interest for potential applications in advanced optical and electronic devices. While ordered molecular growth on metal surfaces is well established, comparatively little attention has been paid to silicon, which remains the predominant material in modern semiconductor technology. On pristine silicon surfaces, the high density of dangling bonds typically impedes the formation of well-ordered organic films, making appropriate surface modification essential.

Here, we demonstrate that rare-earth-modified Si(111) surfaces provide suitable templates for ordered molecular growth [1]. Using scanning tunneling microscopy (STM) at room temperature, we investigated the adsorption behavior of organic molecules with widely differing degrees of chemical reactivity. These include highly reactive N-heterocyclic carbenes (NHC), moderately reactive PTCDA molecules, and weakly interacting transition metal phthalocyanines. At submonolayer coverages, most molecules remain mobile on the surface, whereas highly ordered films form at monolayer coverage for all systems investigated. Figure 1 shows representative STM images of the ordered structures formed by IPr-NHC, PTCDA, and cobalt phthalocyanine. In all three cases, the molecules form highly ordered commensurable monolayers, with the corresponding periodicities indicated in the STM images.

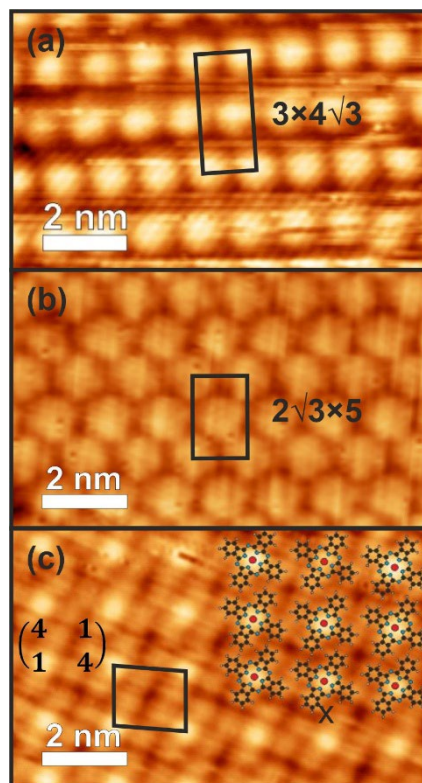


Figure 1: Highly ordered commensurable molecular films on terbium-modified Si(111): (a) IPr-NHC layer, b) PTCDA layer, and (c) CoPc layer.

These findings establish rare-earth-modified silicon surfaces as promising templates for the growth of ordered organic thin films and demonstrate their suitability for molecular layers with markedly different chemical reactivities.

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