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Adsorption Behavior of Selected Aromatic Molecules on Cu(111)

XING LIN, KI-YOUNG KWON, GREG PAWIN, ERICK ULIN-AVILA, LUDWIG BARTELS — The interaction of thiophenol (TP) and its halogen substituted derivatives (X-TP) with a Cu(111) surface has been studied with a combination of temperature programmed desorption (TPD) and scanning tunneling microscopy (STM). TPD data shows desorption of the intact molecules from the multilayers at temperatures that increase with the size of the halogen substituent from F to Br. For the monolayers the carbon-sulfur bond breaks, the sulfur atom remains bound to the surface and the remainder of the molecule desorbs as. Exclusively in the case of Br-TP we observe Ullmann coupling and biphenyl desorption. In the sub-monolayer regime, STM studies reveal all molecules adsorb with the benzene ring near parallel to the surface. At 80K substituted molecules are mobile and self-assemble into ordered islands. Upon desorption of the molecules by thermally breaking the C-S bond, the remaining sulfur atoms form characteristic reconstructions of the Cu(111) substrate. Moreover, we studied the adsorption structure of 2,5-diphenyl-1,3,4-oxadiazole on Cu(111). Prior to adsorption, the rings of this molecule are coplanar. Our STM images indicate that the molecule retains this symmetry and adsorbs with the ring vertical to the substrate in marked contrast to the thiol-bound species.

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