Structural Evolution of a Cyclooctatetraene Adlayer on Cu(111) During Isothermal Desorption

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The use of helium diffraction patterns to study desorption processes is explored as a novel extension to traditional methods based on helium specular reflection. The sample, cyclooctatetraene adsorbed on Cu(111), provides a rich but complex structure. The modulation of cyclooctatetraene by Cu(111) is manifested as a convolution in the diffraction pattern, displaying an averaged super-cell symmetry of $(7\sqrt[]{3} \times 7\sqrt[]{3})R30^{\circ}$. The adlayer expands during isothermal desorption, and the change in lattice constant provides a direct measure of the coverage as a function of time. We find a desorption energy of $0.96\pm 0.01 ~\mathrm{eV}$ at saturation of the first layer, and an upper limit of $1.62\pm0.07 ~\mathrm{eV}$ for isolated molecules. These values, and details of the assigned structure, indicate chemisorbed molecules with a planar conformation.