TEMPLATING SPONTANEOUS MOLECULAR CHAIN GROWTH WITH FEEDBACK-CONTROLLED LITHOGRAPHY

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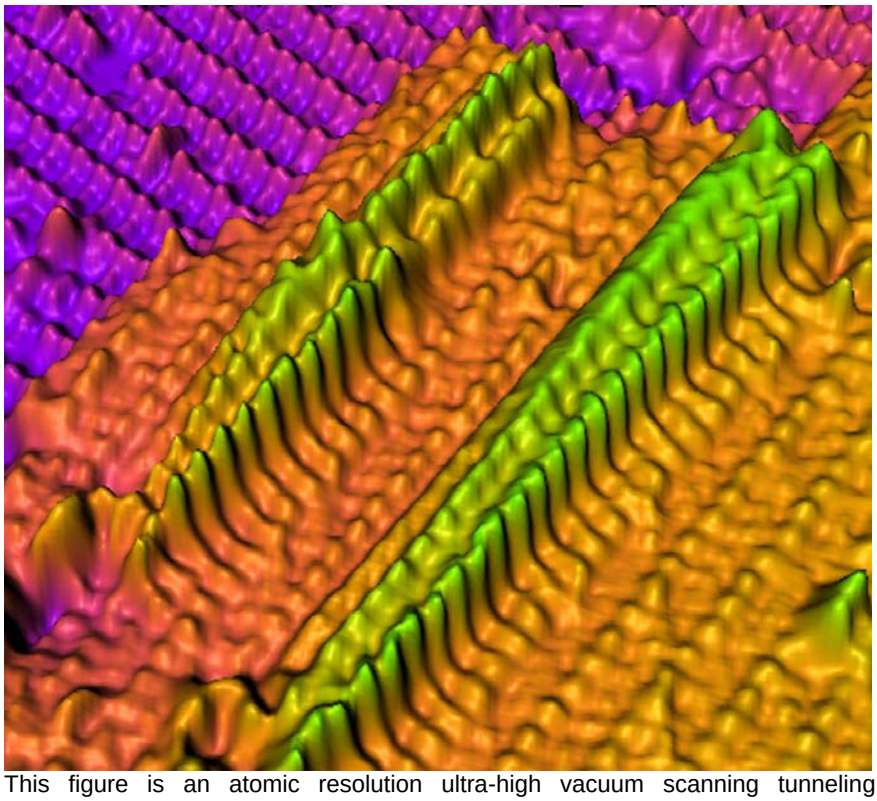
Feedback-controlled lithography (FCL) is an atomically precise technique for nanopatterning individual organic molecules on silicon surfaces using ultra-high vacuum scanning tunneling microscopy. Although FCL enables unsurpassed spatial resolution, its serial nature limits throughput. This speed limitation has been overcome by combining FCL with a spontaneous molecular chain growth process. In particular, FCL is used to pattern individual dangling bonds on hydrogen-passivated silicon. These dangling bonds subsequently serve as initiation sites for the growth of styrene molecular chains that are oriented along the crystalline axes of the underlying silicon surface. Since the growth occurs spontaneously and in parallel, the nanofabrication time is significantly reduced. The figure below shows an image of two styrene chains on silicon. These chains can be used in a variety of applications ranging from nanoscale biological and chemical sensors to electronic devices. Furthermore, since the chains are patterned on silicon surfaces, they can be directly interfaced with conventional silicon microelectronic technology.



This figure is an atomic resolution ultra-high vacuum scanning tunneling microscopy image of one-dimensional styrene molecular chains on the technologically significant hydrogen passivated silicon surface. The apparent width of the styrene molecular chains is approximately 1 nanometer.