

STM-induced Surface Modification with Reactive Ion Etch Pattern Transfer

Richard Silver, Kai Li, Summanth Chikkamaranahalli, Pradeep Namboodiri and Joe Fu

There has been a recent focus on developing reproducible and robust methods for nanometer-scale fabrication using scanning tunneling microscope- (STM) based tip processes. In this presentation we will discuss recent research in silicon surface preparation and fabrication methods using STM surface modification. We have developed a process for hydrogen termination of silicon surfaces followed by a high-resolution local oxidation procedure. Results using ambient wet chemical-prepared hydrogen-terminated silicon surfaces showed that features smaller than 10 nm could be patterned in a UHV environment. Current laboratory work is focused on extending this technique to the atomic domain by moving the hydrogen termination process into a UHV environment. This technique utilizes an STM tip to locally desorb the hydrogen termination and form a patterned oxide on the surface which then serves as a hard etch mask. The presentation will cover details of the surface preparation procedures, STM patterning method and subsequent reactive ion etching (RIE) procedures developed to pattern 10 nm sized structures. The presentation material will also include recent results using a field ion microscope (FIM) to prepare atomically sharp STM tips. Methods used to obtain reproducible single crystal W tips will be described as well as subsequent imaging performance.