Abstract Submitted
for the MAR09 Meeting of
The American Physical Society

Direct writing of hafnium diboride metallic nanostructures on silicon (100) surfaces using a UHV-STM WEI YE, University of Illinois at Urbana Champaign, PAMELA MARTIN, NAVNEET KUMAR, JOHN ABELSON, GREG GIROLOMI, ANGUS ROCKETT, JOSEPH LYDING, University of Illinois at Urbana Champaign — The patterning of metallic nanostructures on surfaces is of great interest in fabricating nanoelectronics and quantum devices. In this work, we deposited HfB_2 nanostructures on silicon surfaces from $Hf(BH_4)_4$ by electron beam induced deposition (EBID). At positive sample bias, the electron beam from a STM probe initiates the local CVD by the decomposition of $Hf(BH_4)_4$ under STM tip. By repeatedly scanning STM tip along a specific path, well-defined HfB_2nanostructures can be directly written onto the surface. Scanning tunneling spectroscopy was used to characterize the electronic properties of the nanostructures. We have achieved 4 nm linewidths and complete selectivity relative to adjacent H-Si(100) regions. The thickness of the nanostructures is controlled by the exposing time to the electron beam from STM tip, while the width is controlled only by the geometry of the tip apex and the sample-tip separation. STS data confirm that the HfB_2 nanostructures deposited are pure metallic, indicating minimum contaminations in the nanostructures, which we attribute to the carbon-free nature of the CVD precursor. To our knowledge this is the first demonstration of sub-5 nm metallic nanostructures in a STM/CVD experiment.

Wei Ye
University of Illinois at Urbana Champaign

Date submitted: 23 Nov 2008 Electronic form version 1.4