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Scanning Tunneling Spectroscopy Study of Single Layer Step Edges on Si (100) Surfaces. XIQIAO WANG, University of Maryland-College Park, PRADEEP NAMBOODIRI, KAI LI, XIAO DENG, RICHARD SILVER, National Institute of Standard and Technology — Advanced Hydrogen lithography enables the fabrication of atomically precise donor-based quantum devices on Si(100) surfaces. Understanding the defect and step edge interaction with local electronic and geometric structures is needed to properly interpret device measurement results. Low temperature Si epitaxy, used to encapsulate devices, introduces island growth and step edges near/above buried donor nanostructures, presenting a real challenge in relocating and characterizing buried donor devices using Scanning Tunneling Microscopy/Spectroscopy (STM/STS). We present spatially resolved STS results across single layer steps on Si(100) surfaces. While the electronic properties across SA steps were found to be very similar to that on flat terraces, we observed an edge induced gap state on rebonded SB step edges, which was assigned to the unpaired dangling bond state at the lower edge atom of the rebonded SB steps. In addition, we used computational simulation within Bardeen's formalism to probe the influence of subsurface doping density profiles on the observed STS features over step edges and other defects. This study will help to elucidate the role played by surface step edges and subsurface doping densities in characterizing surface and subsurface nanostructures using STS/STM.

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