Atomically Defined Wires on P-Type Silicon

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Dangling bonds (DBs) on a hydrogen terminated Si(100)-2x1 surface are silicon atoms unbound to hydrogen atoms. They are point defects with electronic states in the band gap. Placing DBs at strategic locations on the surface enables them to be used as fundamental components for atom-defined electronics. In this work, we use low temperature scanning tunneling microscopy techniques to create patterns on boron-doped silicon. We find that wire structures consisting of DB pairs exhibit 1D quantum wells within the band gap. Combining these wires with local point structures make them candidates for electronic control at the atomic scale. The wires exhibit relative immunity to environmental degradation. The natural reactive and thermal robustness of the dangling bond lines combined with vacuum encapsulation is expected to result in very long-lived circuitry. Synthesis and characterization of wires and wires adjacent to other structures will be shown.