

# Nanoscale molecular electronic circuits

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Recent advances in molecular electronics has led to considerable promise of scaling circuits further down at nanometer scale due to the inherently small nature of molecule. We have developed a process to fabricate crossbar molecular circuits with the highest density electronically addressable memory reported to date. In the circuits, the electrodes were defined by imprint lithography. The basic element in the circuit is the Pt/molecule/Ti junction formed at each cross point that acts as a reversible and nonvolatile switch, and 64 such switches are connected to form an  $8 \times 8$  crossbar circuit within an  $1 \mu\text{m}^2$  area. To demonstrate a demultiplexer/multiplexer functionality integrated with memory, we have also configured a defect-free  $8 \times 8$  crossbar into a  $4 \times 4$  memory and two  $4 \times 4$  decoders for the demultiplexer/multiplexer by setting the resistances at specific cross points. The nanoscale wires can also be used to fabricate chemical and biological sensors. We have explored the potential to use the nano-fabrication technology and molecular circuits to fabricate high-density sensors.

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