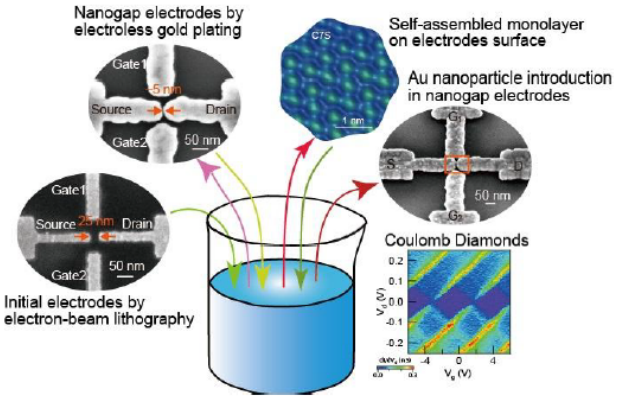
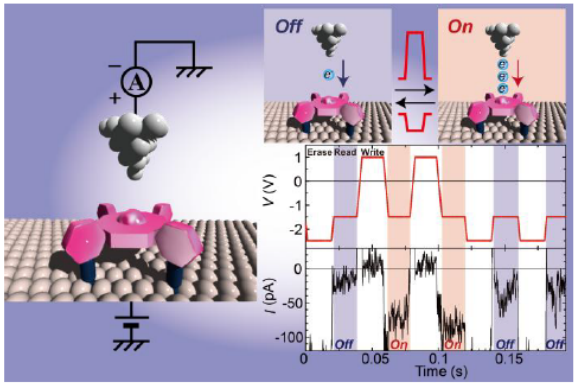
Molecular devices and nanoparticle devices by utilizing bottom-up processes

Bottom-up electronics enables us to fabricate chemically assembled single-electron devices and molecular devices with high sub-nm precision by dipping a sample into solutions. We have established the electroless plating process for nanogap electrodes with 5 nm or less gap separation at sub-nm scale precision. By using these nanogap electrodes and the nanoparticle, we have demonstrated the exclusive or (XOR) operation on the double side-gate single-electron transistors. We have also demonstrated the Coulomb blockade phenomena on a gold nanoparticle at room temperature by scanning tunneling microscopy (STM) and scanning tunneling spectroscopy (STS). Our goal is to demonstrate the solid-state single-electron devices and molecular devices operations at room temperature toward the next sub-10 nm scale electronics.



Chemically assembled single-electron transistor and Coulomb diamond characteristic.



Room temperature single-molecular memory