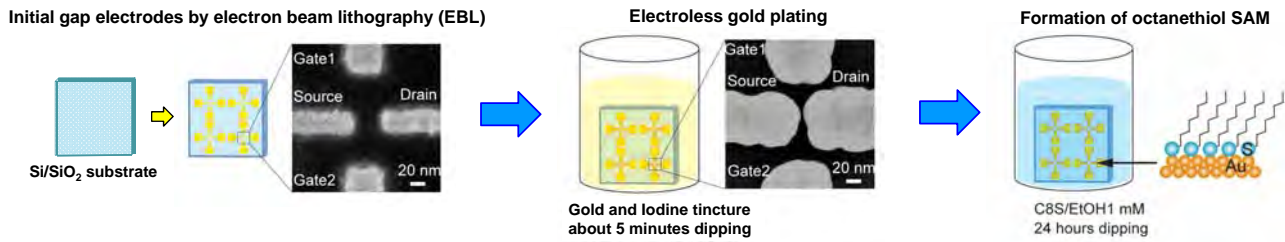


1. Abstract

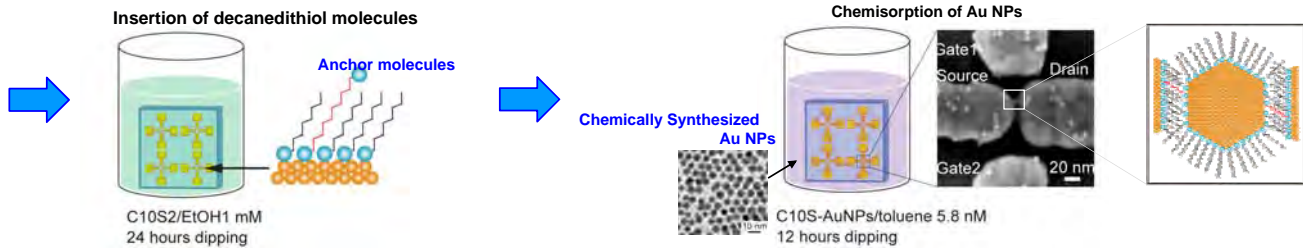
- Single-electron transistors (SETs) have been expected towards highly integrated circuits. However uniform and stable device characteristics and the possibility of large area integration, including wiring are required for their real applications.
- SiNx-passivated chemically assembled SETs were developed. With an Au top-gate electrode, the SiNx-passivated SETs showed a clear Coulomb diamond, and the gate capacitance increased 16.5-fold.

2. SiNx-Passivated SET made by Au Nanoparticles and Nanogap Electrodes

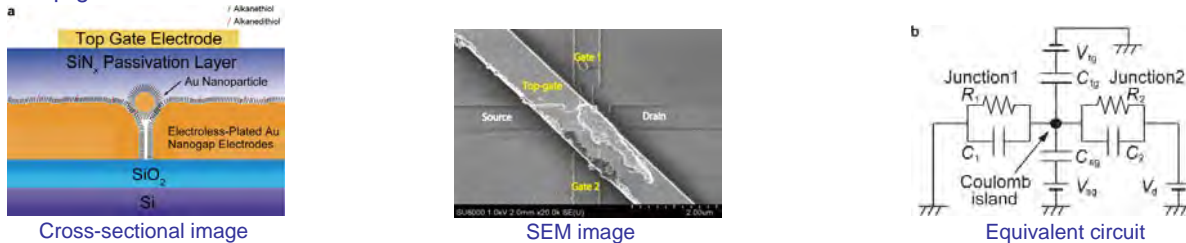
- Bottom-up processes that combine the use of synthesized Au nanoparticles (NPs), electroless plating, and self-assembled processes at a very small scale (< 5 nm) for chemically assembled SETs have been established.



- Chemically synthesized Au nanoparticles with a core diameter of 6.2 ± 0.8 nm were then chemisorbed using an alkanedithiol mixed self-assembled monolayer as an anchor.

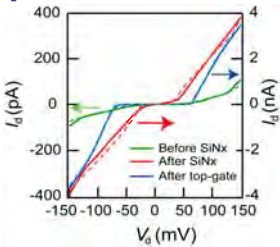


- The SiNx passivation layer was realized by catalytic chemical vapor deposition (CAT-CVD) up to a thickness of 50 nm, then top-gate electrodes were added.

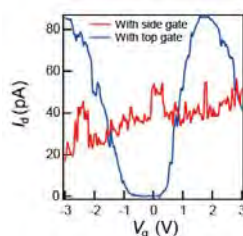


SiNx-passivated SET with a top-gate electrode

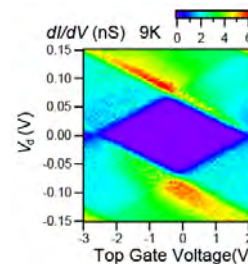
3. Experimental Results



Id-Vd characteristics at 9K



Coulomb oscillation observation



Stability diagram of the device at 9K

	R_1 (M Ω)	R_2 (M Ω)	C_1 (aF)	C_2 (aF)	C_g (zF)	Q_0 (e)
Before SiNx deposition	500	500	1.0	0.8		0.2
After SiNx deposition	110	100	1.0	0.8	2.3	0.35
After top-gate electrode deposition	90	170	1.0	1.15	38	-0.07

Circuit parameters of the SET

- The use of the top-gate electrode allowed us to increase the gate capacitance 16.5-fold.
- The experimental Coulomb diamond corresponds to the ideal theoretical results.
- Au nanoparticle withstands the CAT-CVD process for SiNx passivation.

Patent Licensing Available

Patent No.: WO2013/129535

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