

## Nanowire:

Construction: <https://en.wikipedia.org/wiki/Nanowire>

- Bottom-up vs. Top-Down
  - suspension: requires high-vacuum chamber.
    - chemically etching larger wire
    - bombarding larger wire with energetic ions
    - indenting the tip of a scanning tunneling microscope into the surface of a near melting metal, then retracting the microscope.
  - Vapor-Liquid-Solid Growth: requires a catalyst (gold works really well).  
[https://en.wikipedia.org/wiki/Vapor%E2%80%93liquid%E2%80%93solid\\_method](https://en.wikipedia.org/wiki/Vapor%E2%80%93liquid%E2%80%93solid_method)
    - liquid catalyst nanodroplets are added to a base substrate
    - gaseous source is then feed.
    - Catalyst absorbs the vapor to the point of supersaturation which causes crystal growth.

Similar Current Developments:

- NRAM: <https://en.wikipedia.org/wiki/Nano-RAM>
  - Nan-RAM
  - developed by Nantero
  - nonvolatile, makes use of carbon nanotubes.
- Memristors: <https://en.wikipedia.org/wiki/Memristor>
  - Memory resistor
  - resistance is dependent on how much current has flowed through the device.
  - Titanium dioxide memristor implemented by Hewlett-Packard.

Uses?:

- Electronic:
  - crossing p/n doped wires has been used to create AND/OR/NOT logic gates
  - NAND gate made from undoped silicon nanowire.
  - Photon ballistics waveguides for quantum logic arrays
    - photons in the tube, electrons on the outside shell.
    - crossing two creates a quantum dot.
- Protein/Chemical detection:
  - real-time sensing of biomarker proteins for cancer
  - detection of single virus particles
  - bomb sniffing that better than dogs.

Issue:

- Physics:
  - conductivity of the wires decreases as the diameter of the wire decreases
  - energy of electrons going through the wire can only assume discrete values
  - values being multiples of the Von Klitzing constant  $G=2e^2/h$ , with  $h$  being the planck constant.
  - This results in MOSFET type devices needing to have higher control voltage.

Sauce:

<https://en.wikipedia.org/wiki/Nanowire>

[https://en.wikipedia.org/wiki/Quantum\\_dot](https://en.wikipedia.org/wiki/Quantum_dot)

<https://en.wikipedia.org/wiki/P%E2%80%93junction>

[https://en.wikipedia.org/wiki/Vapor%E2%80%93liquid%E2%80%93solid\\_method](https://en.wikipedia.org/wiki/Vapor%E2%80%93liquid%E2%80%93solid_method)

<https://en.wikipedia.org/wiki/Nanoelectronics>

[https://en.wikipedia.org/wiki/Crossbar\\_switch](https://en.wikipedia.org/wiki/Crossbar_switch)

<https://en.wikipedia.org/wiki/Nano-RAM>

[https://en.wikipedia.org/wiki/Carbon\\_nanotube](https://en.wikipedia.org/wiki/Carbon_nanotube)

<https://en.wikipedia.org/wiki/Memristor>