Fabrication processes for nanoTrek® devices

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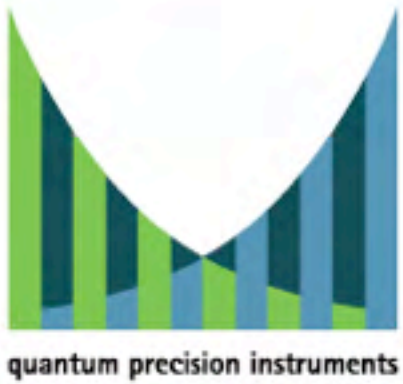

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Quantum Precision Instruments Asia Private Limited

A nanotechnology enabling company developing Nano Electro-Mechanical (NEMS) sensors, wireless smart sensor networks and atomic precision metrology nanoTrek® devices especially useful in security, defense and military, medicine and biotechnology, aviation, maritime and navigation, manufacturing and microelectronics applications, nanotechnology and scientific industries and for consumer products.

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Quantum-π facilities in Singapore

Quantum-π is located
at NUS Business Incubator

Collaborations:

SSLS: Singapore Synchrotron Light Source

SPRING Singapore
Standards, Productivity and Innovation Board

A*STAR
Agency for Science Technology & Research

IMRE
Institute of Materials Research & Engineering

IME
Institute of Microelectronics

DSI
Data Storage Institute

SIMTech
Singapore Institute of Manufacturing Technology

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nanoTrek® : Principle of operation

Demo:
http://www.quantum-pi.com/demo.html

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Fabrication methods for arrays of nanowires

1) MBE + EBL or IBL+ etch, including ion beam etch of fine patterns
2) Pristine semi surface + selective doping along the line pattern
3) Nano-imprint lithography, NIL + ALE
4) Laser-focused atom deposition
5) Laser-focused "etch" in SAMs (ANU, Ken Baldwin)
6) Damascene or double damascene process + CMP
7) MBE -> create superlattices / cleavage (similar to CEO)
8) Selective epitaxial growth
9) Nonlithographic electrodeposition ,,,,,
10) Cleaved Edge Overgrowth (CEO) ,
11) Direct writing ,
12) Laser ablation ,,
13) Ordered growth of directional structures using genetically engineered viruses and supermolecular scaffolds
14) Other Methods of Nanowire Array Fabrication

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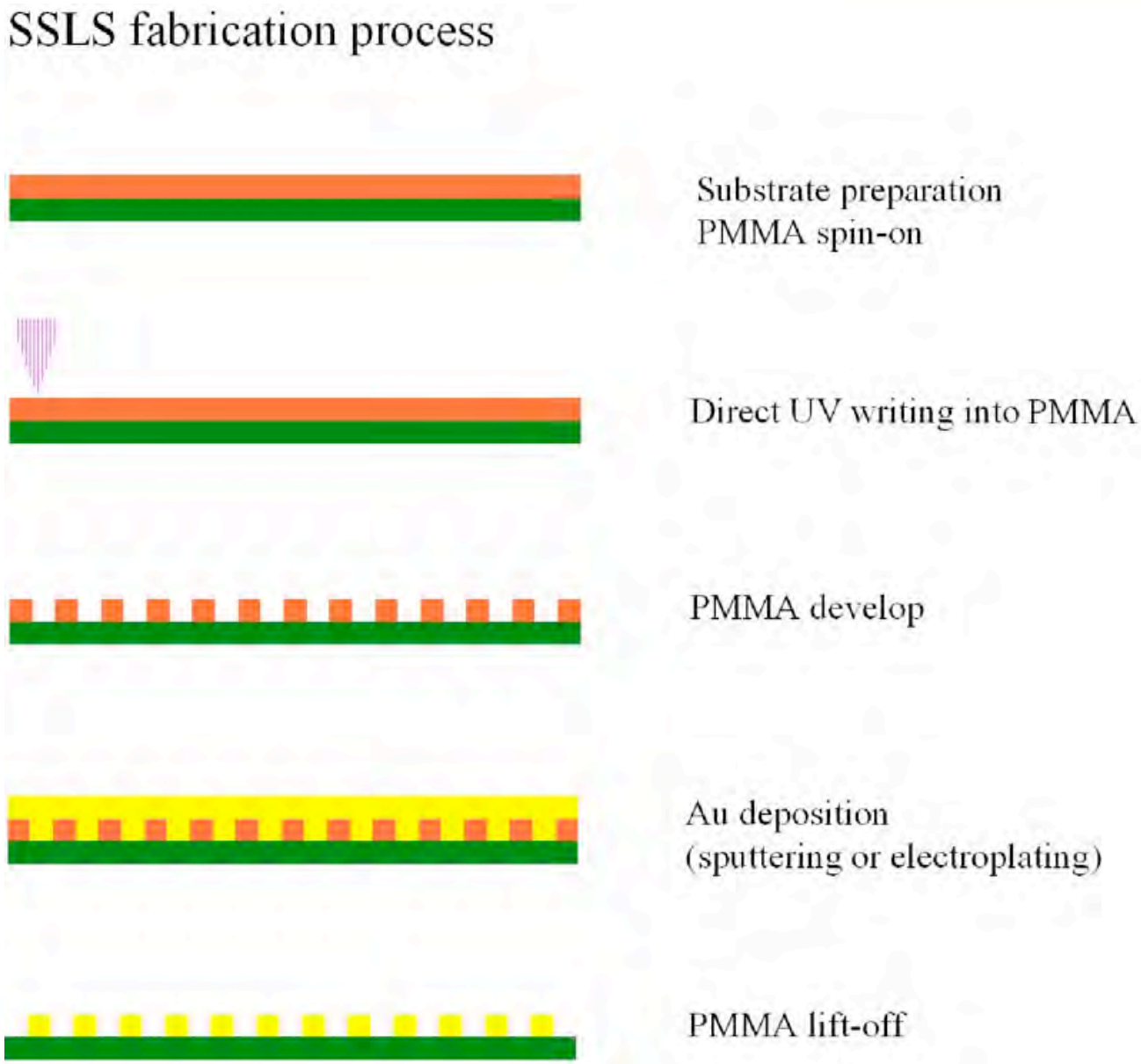
SSLS fabrication process



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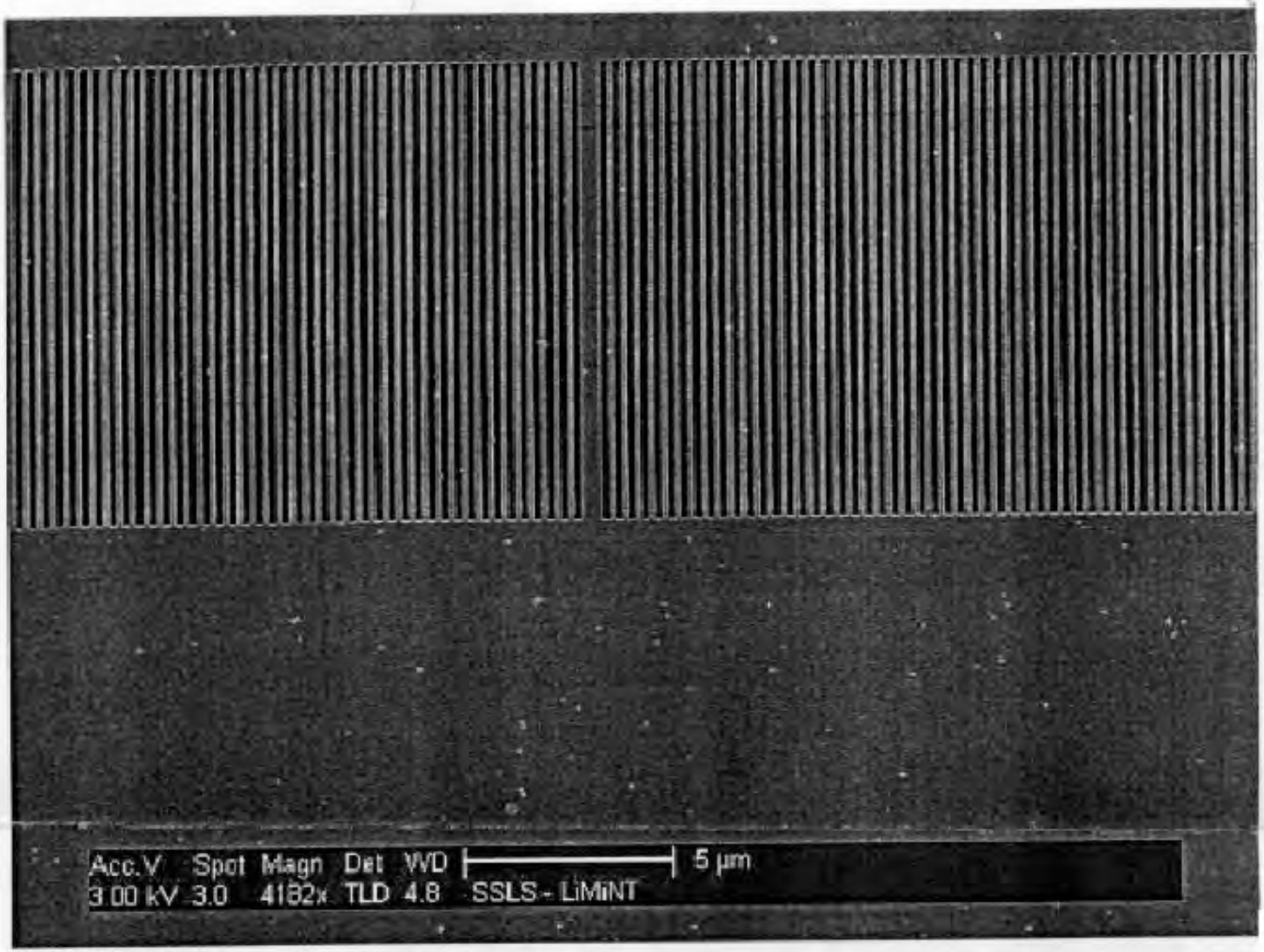
SSLS fabricated nanowires

Nano Lines



PMMA pattern

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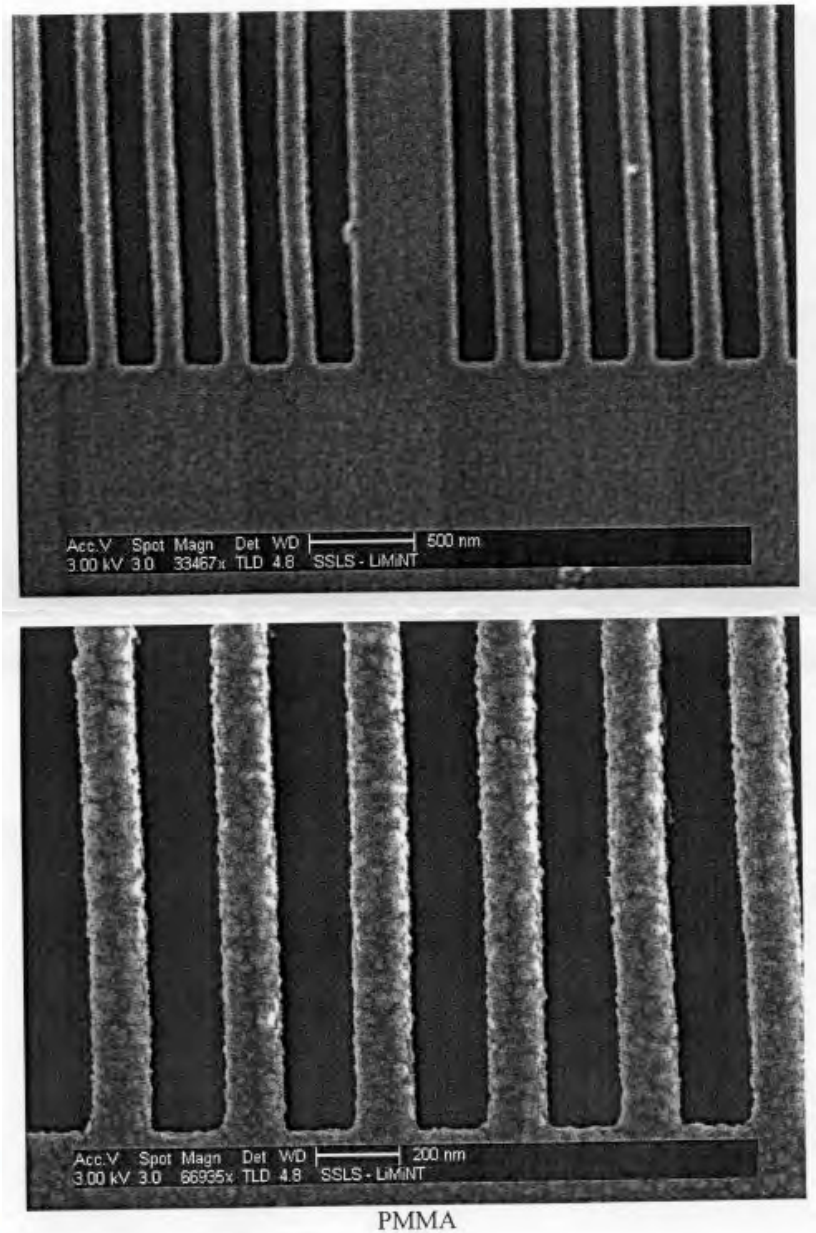
SSLS fabricated nanowires



PMMA

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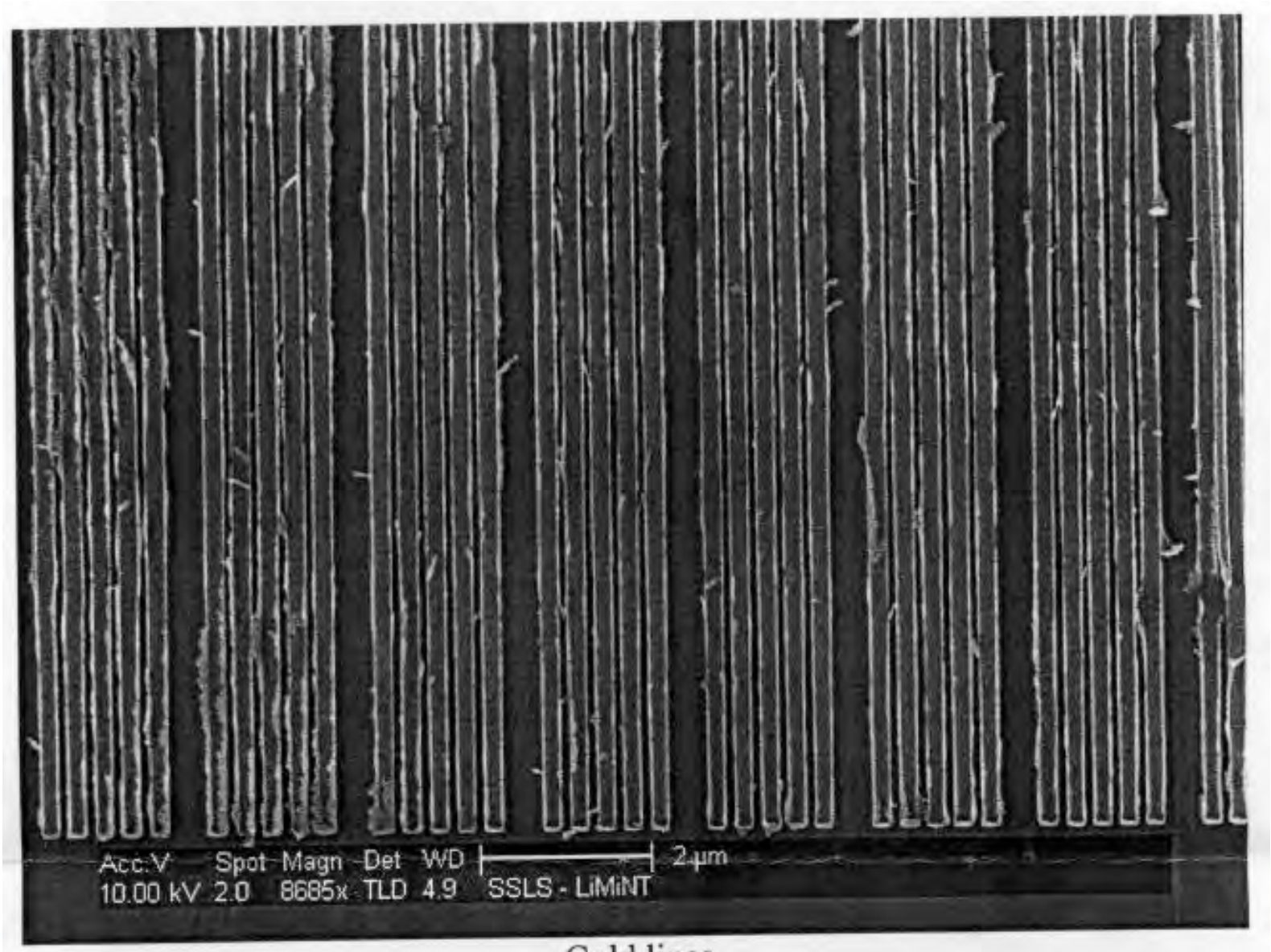
SSLS fabricated nanowires



Gold lines

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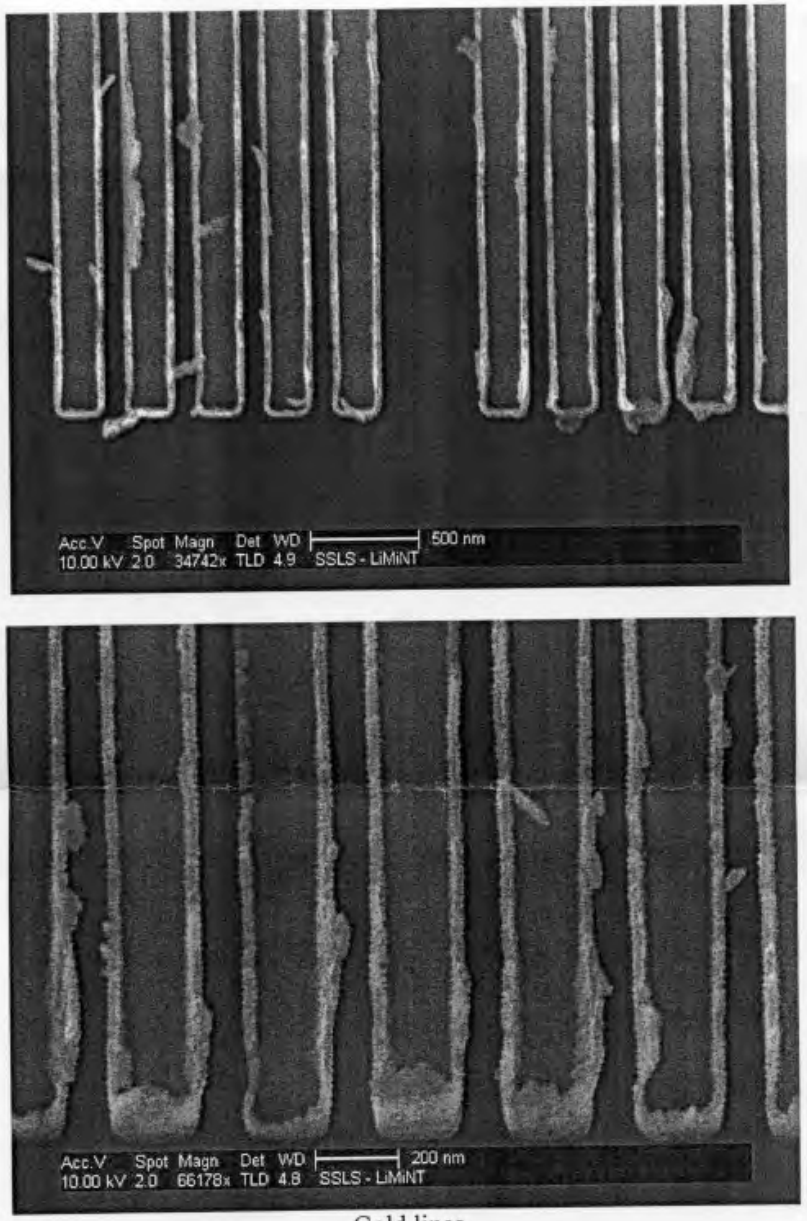
SSLS fabricated nanowires



Gold lines

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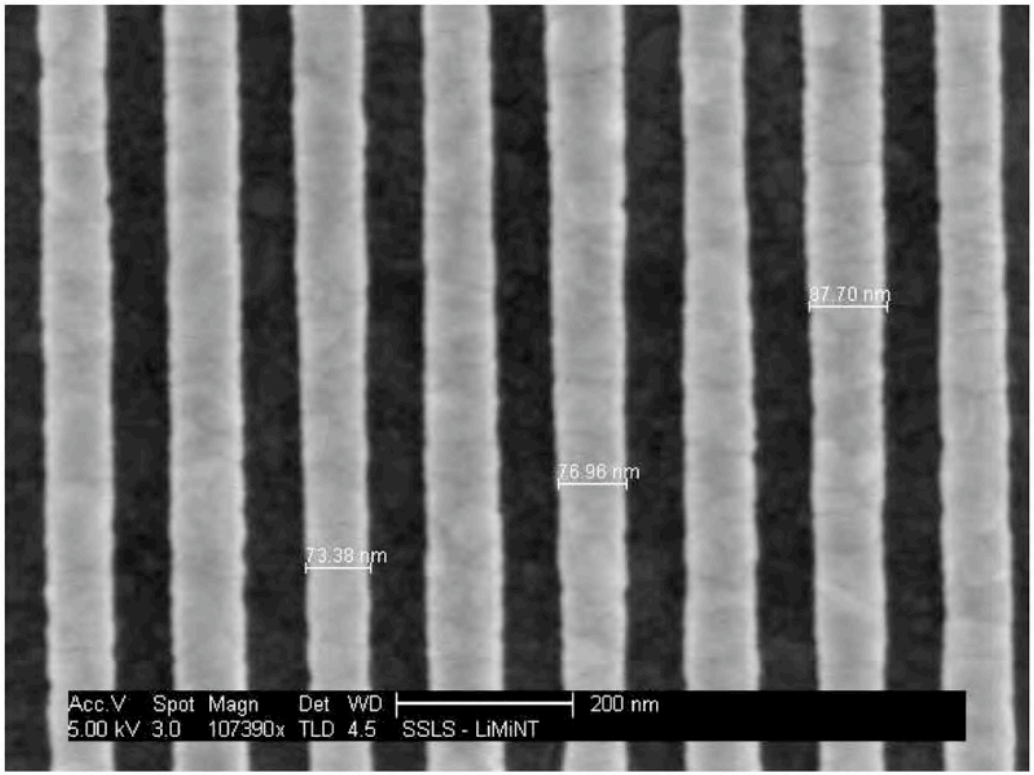
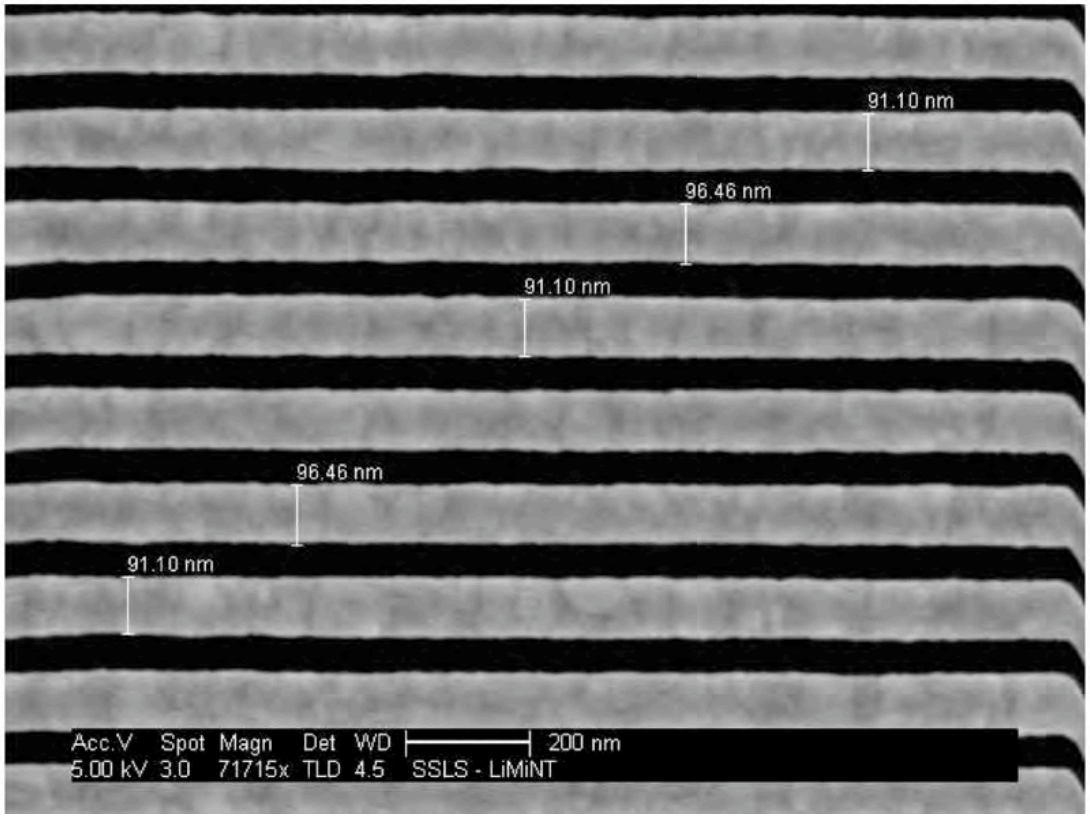
SSLS fabricated nanowires





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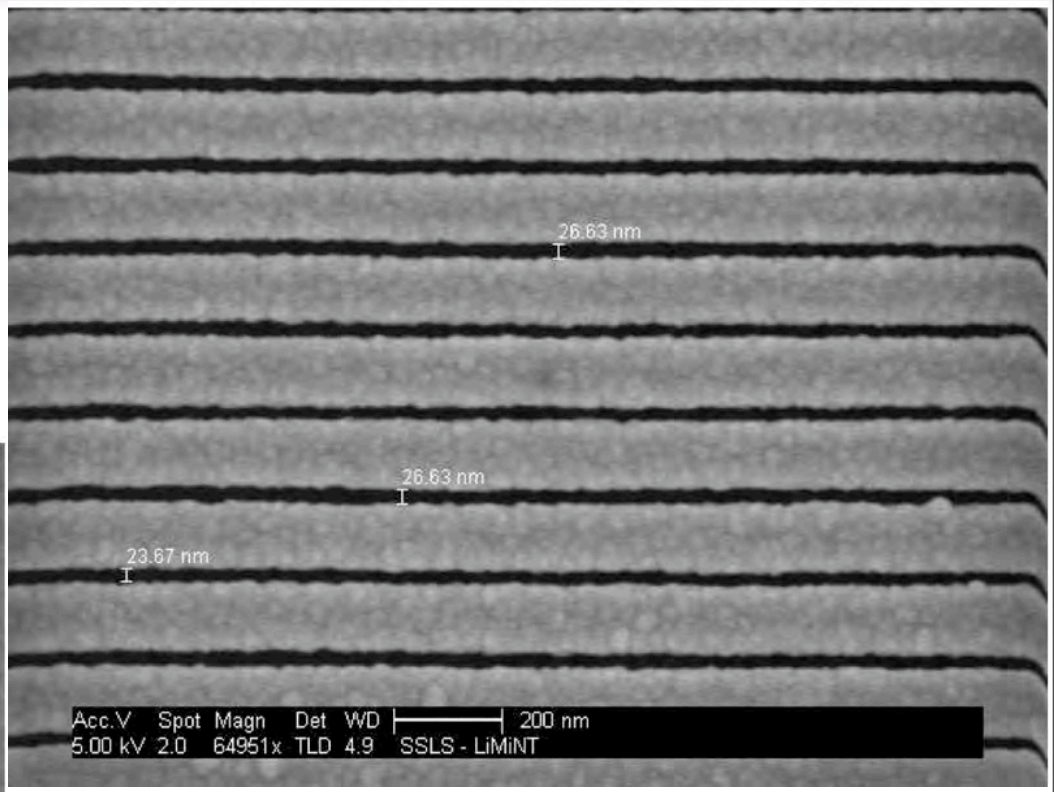
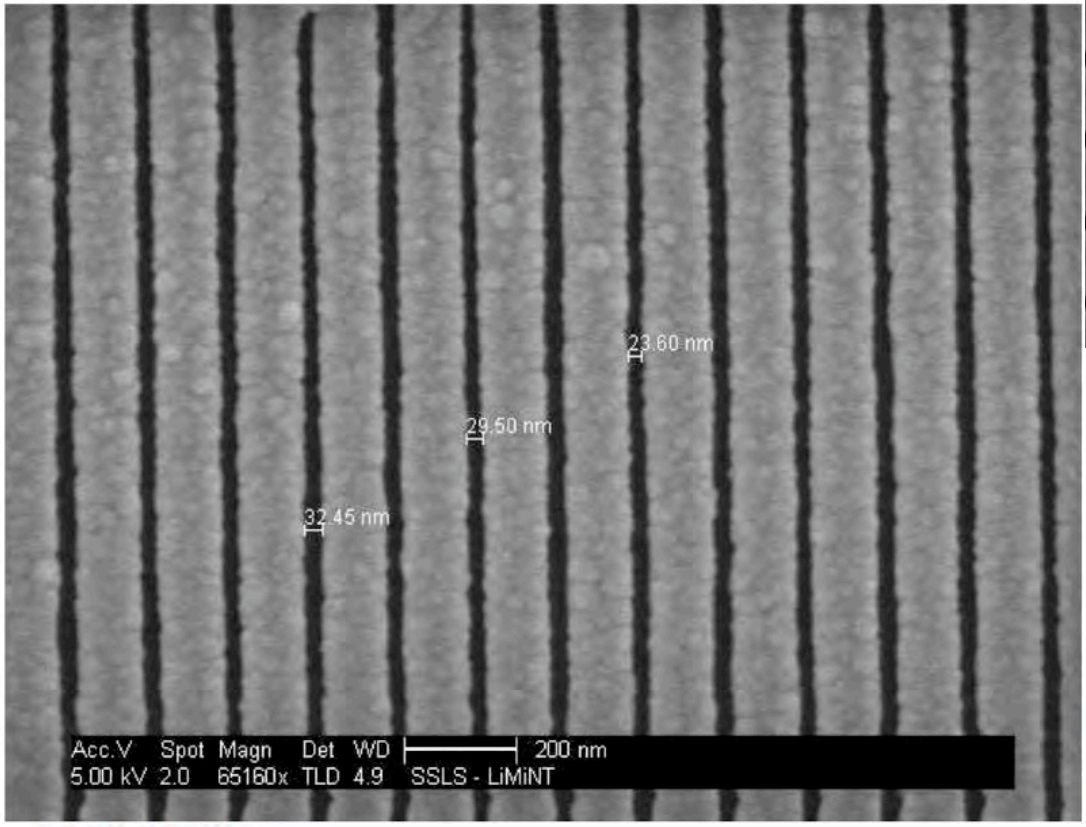
SSLS fabricated nanowires





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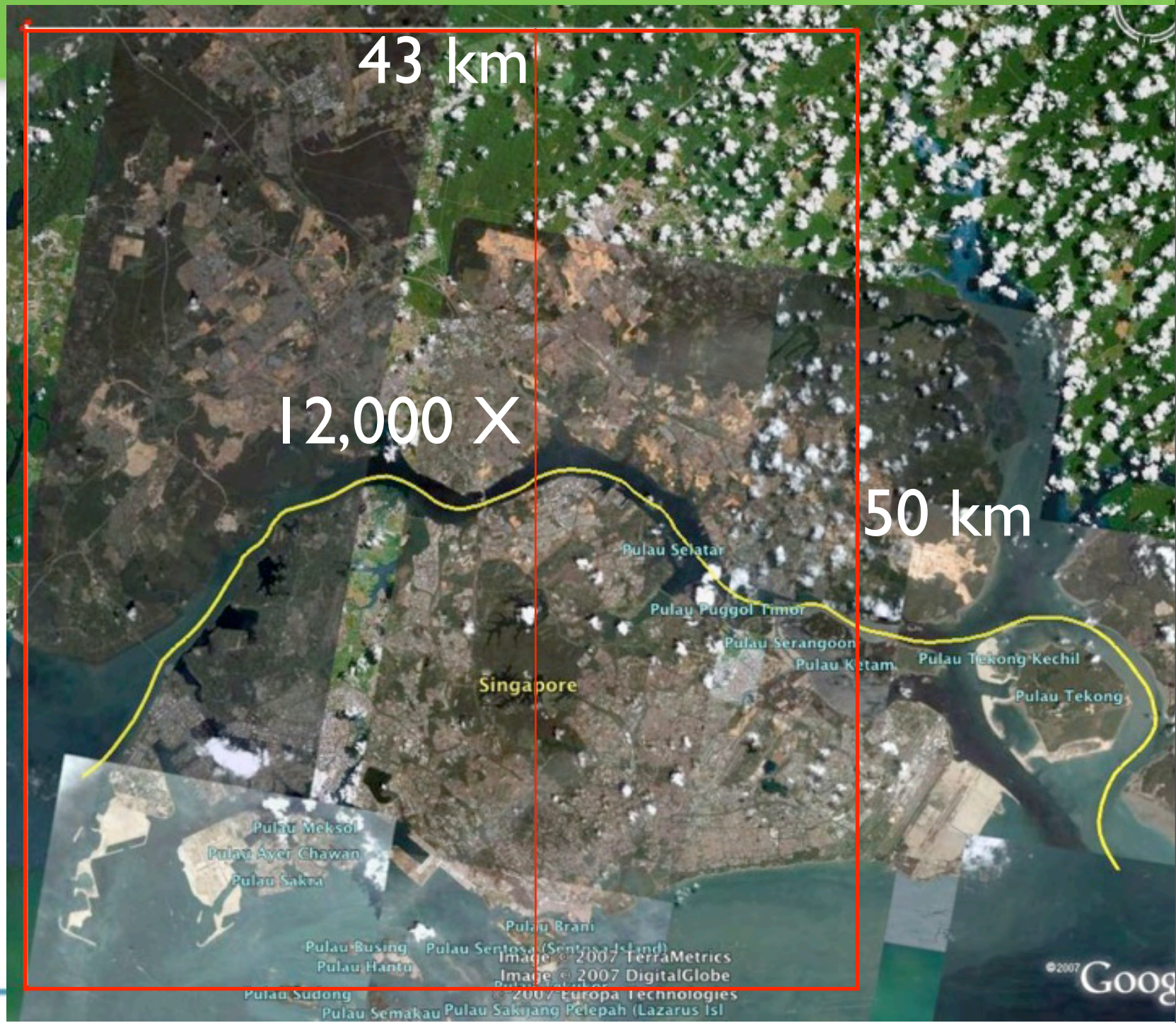
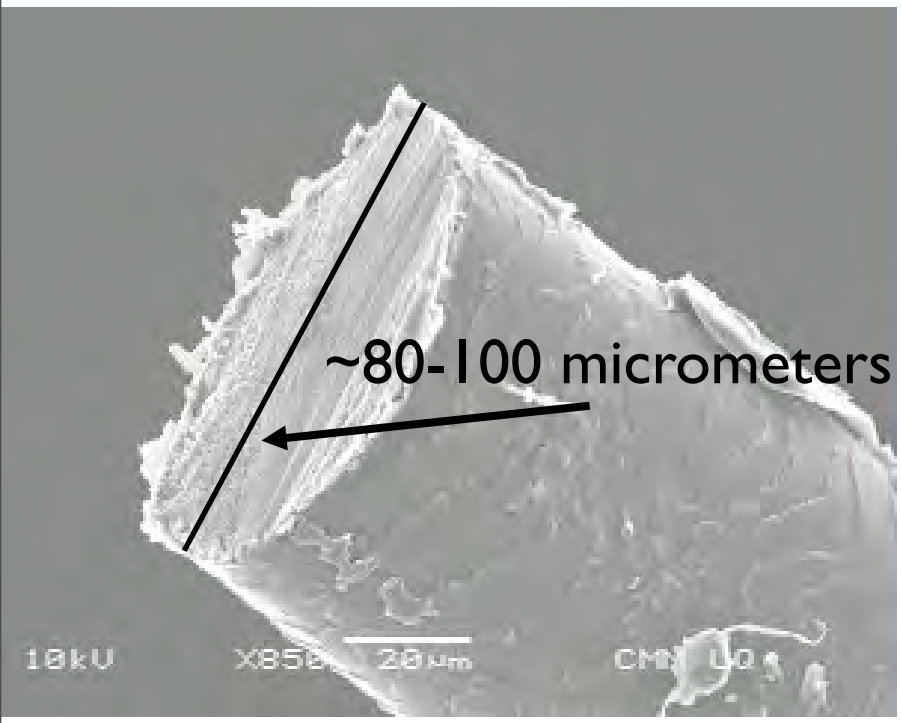
nanoTrek® devices - scale analogy

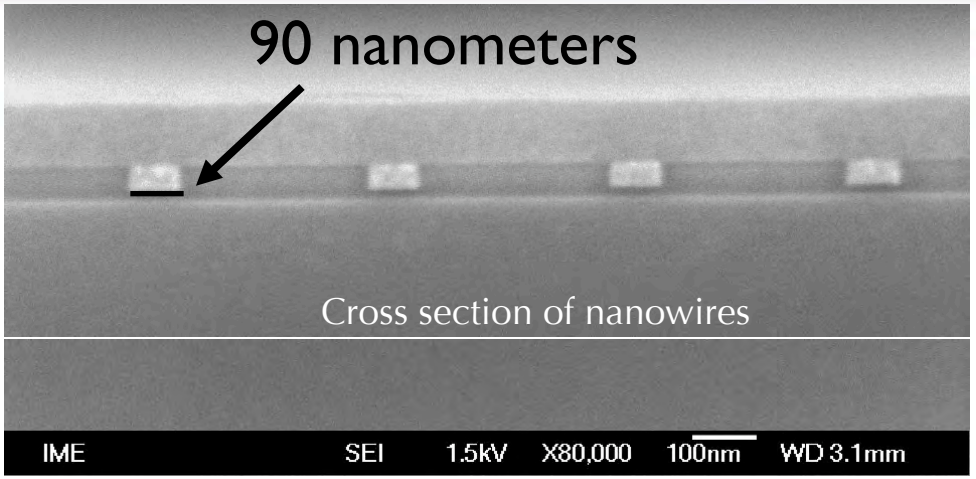
Imagine a straight path 1 meter wide running the entire length of 50 km, and another one, separated by 2 meters, and another one…
Imagine 12,000 such 1m wide and 50 km long paths!
Now, shrink this picture ten million times and you get an image of one of the hundreds of nanoTrek® devices

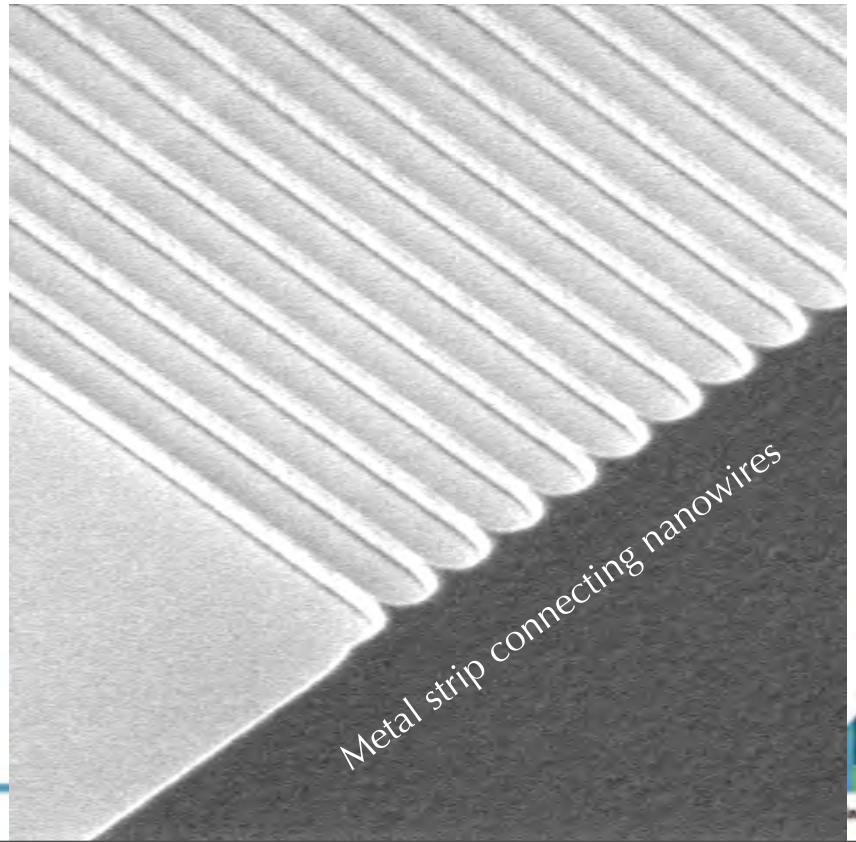


Prototype nanoTrek® devices fabricated at IME



Electron Microscope Image of human hair





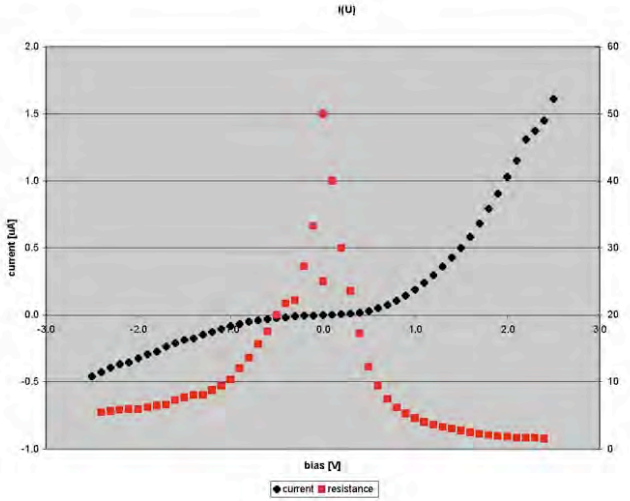
Each nanowire is ~1/1000th width of of human hair!

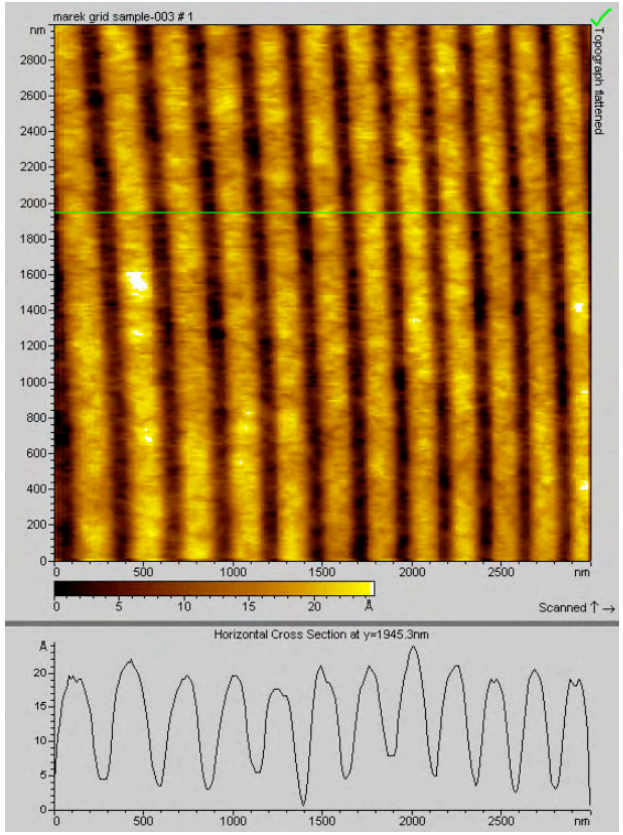
Product 1:
Quantum Tunneling Linear Encoder of Position

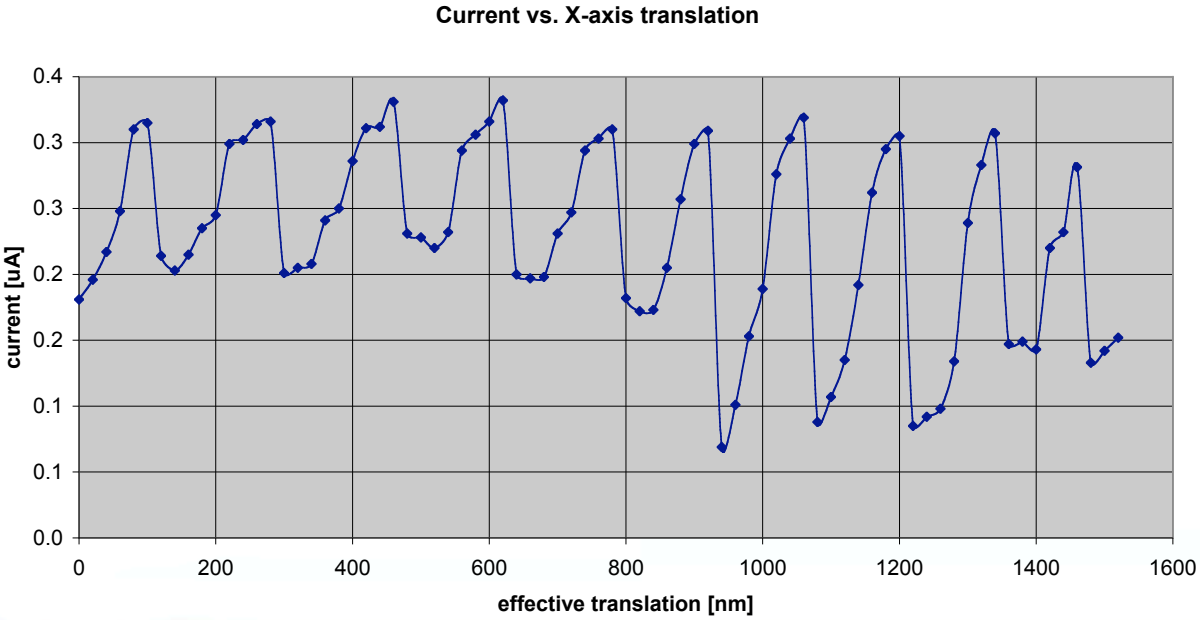
Unique metrology:

Target range: 20 cm

Target resolution: 0.1 pm
(with interpolation)







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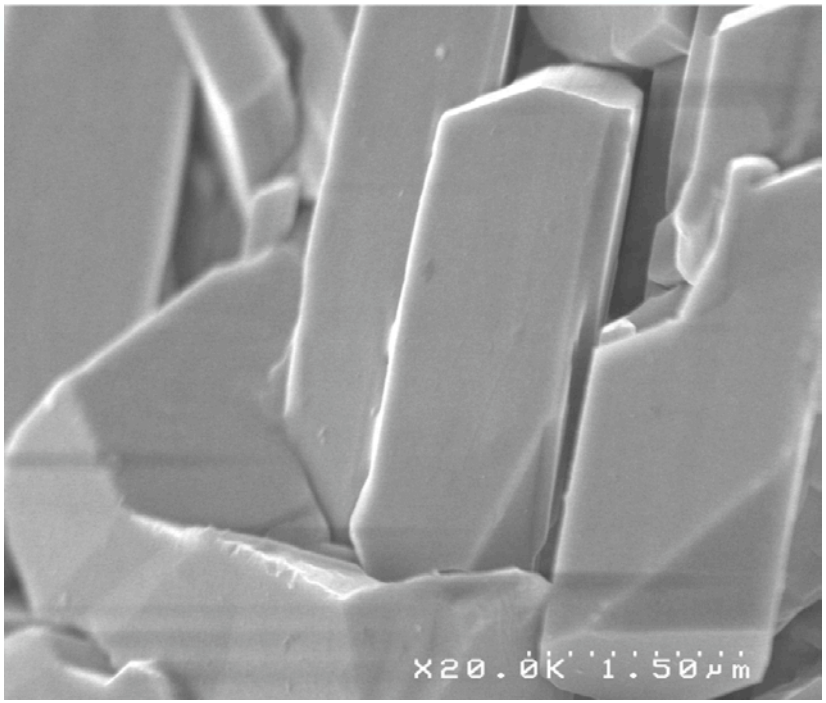

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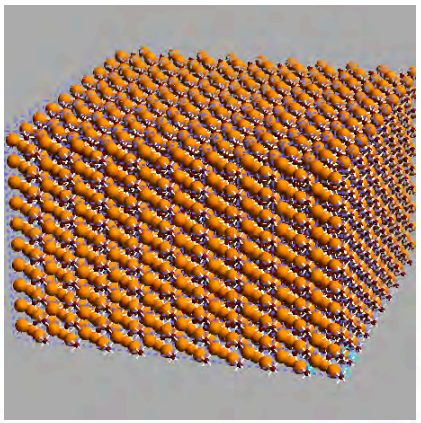

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