

Nanofabrication Research Laboratory (NRL)

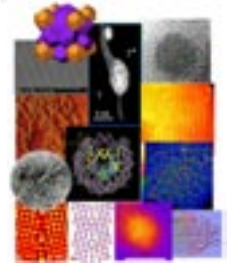
Nanophase Material Sciences Workshop

October 25, 2001

Michael L. Simpson

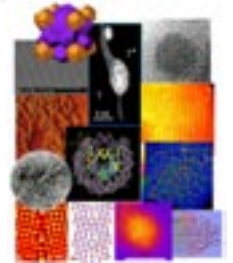
Oak Ridge National Laboratory and

The University of Tennessee

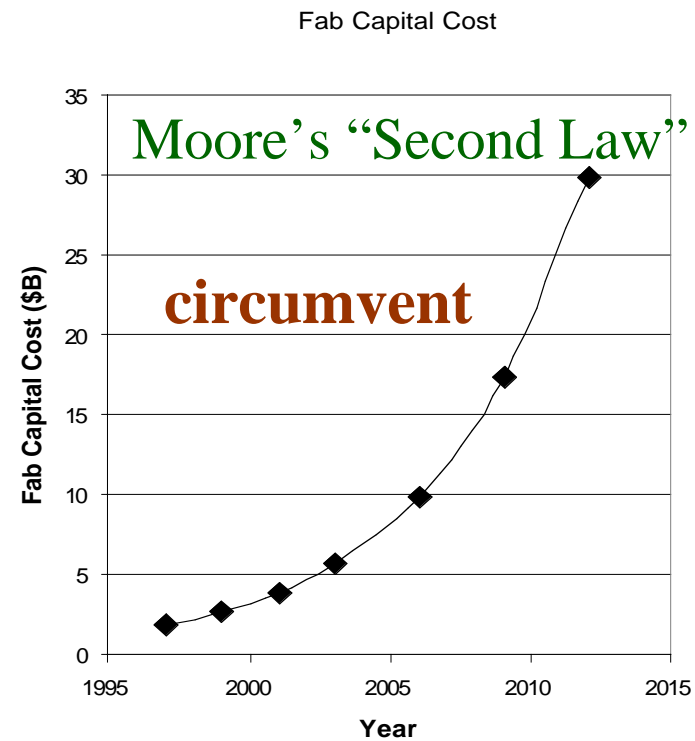
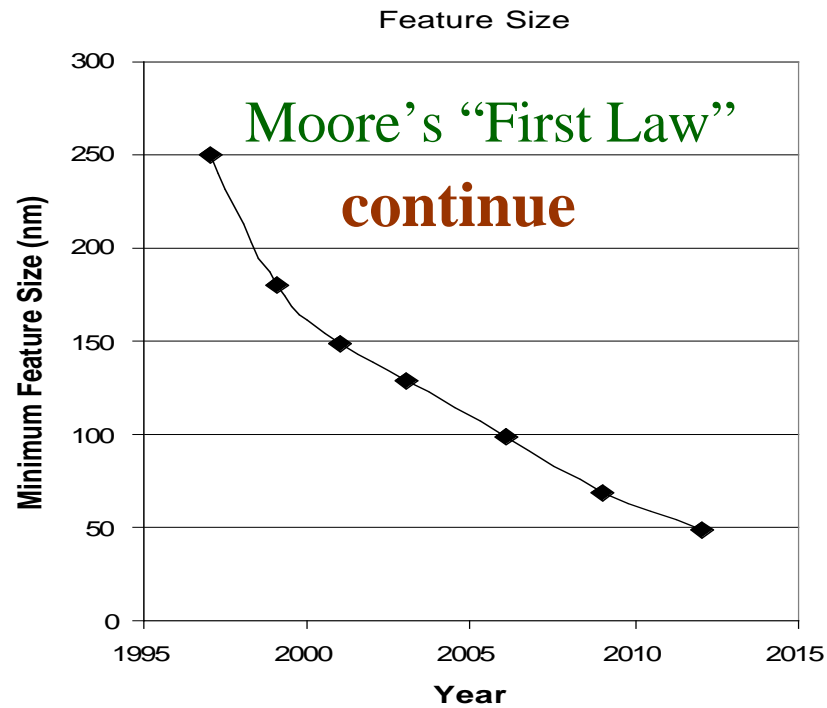


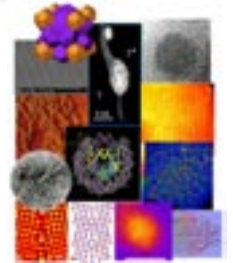
The NRL is *not* a laboratory for fabrication research, but rather the emphasis is *nanofabrication as a tool for science*

- manipulation of structure at the nanoscale -- getting to the size scale where *new physics emerges*
- *interface* of “hard” and “soft” materials (polymers, biomaterials, etc)
- seeding and probing *self-assembly processes*
- complement and extension of *controlled synthesis*

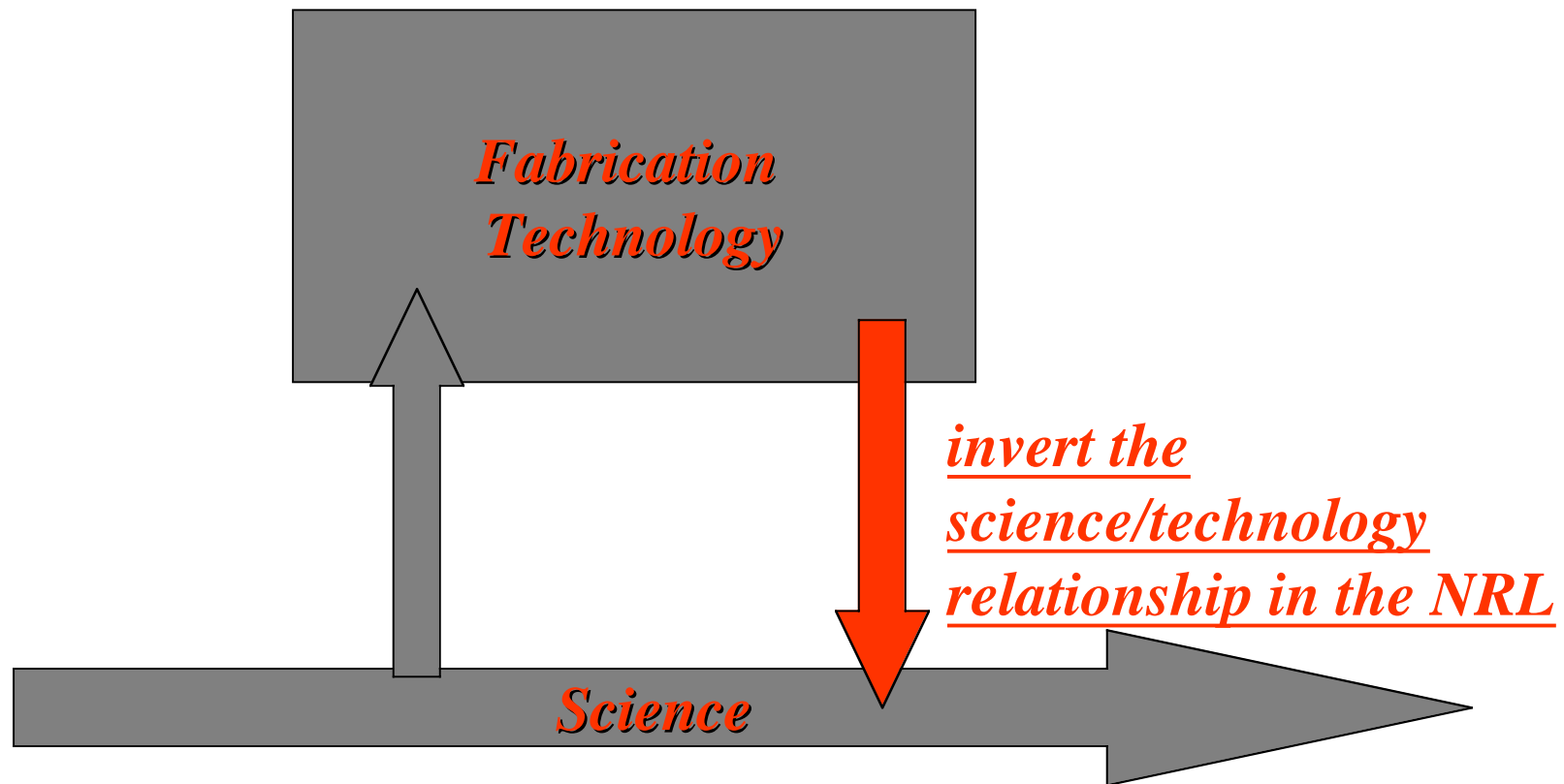


Fabrication research motivation: *Moore's law*



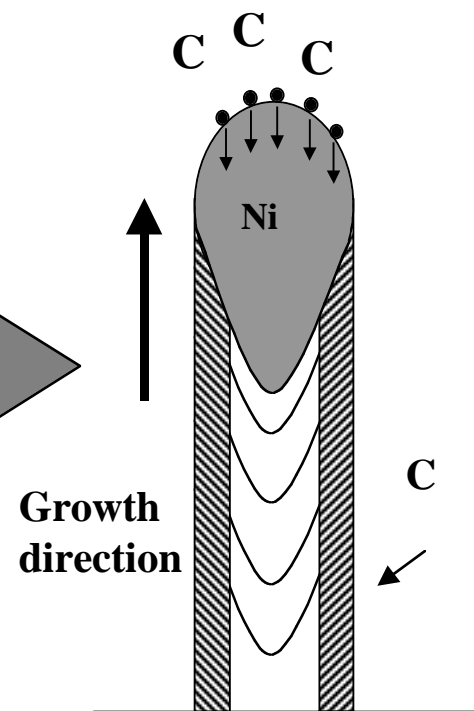
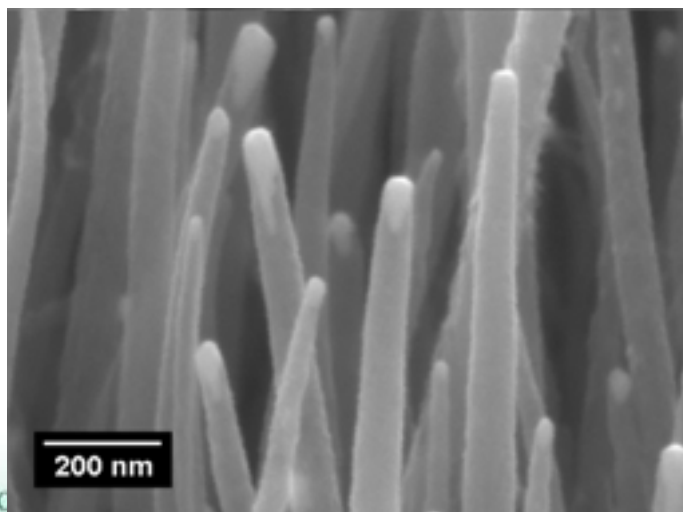
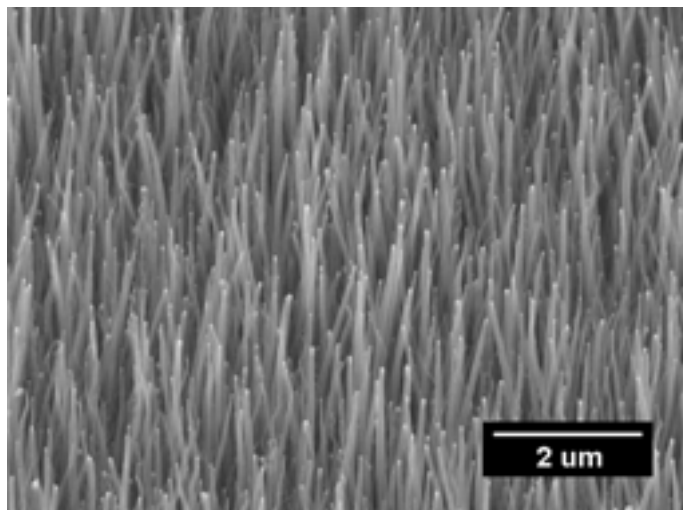
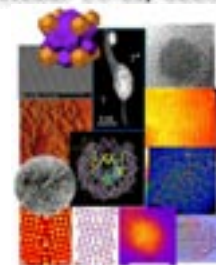


Science/Technology relationship



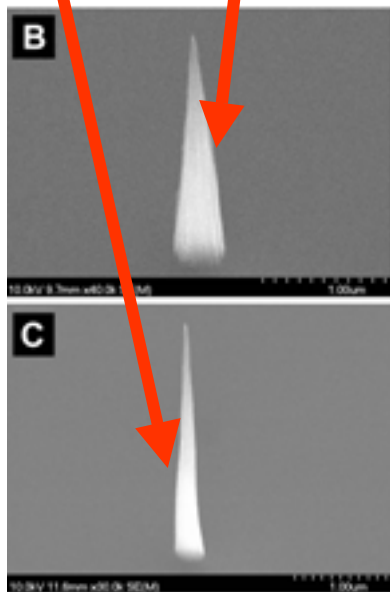
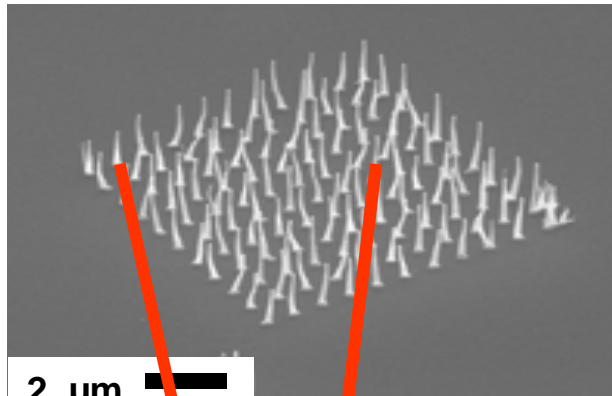
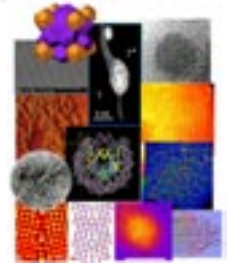
Example: controlled synthesis of carbon nanofibers

Growth from unpatterned catalyst

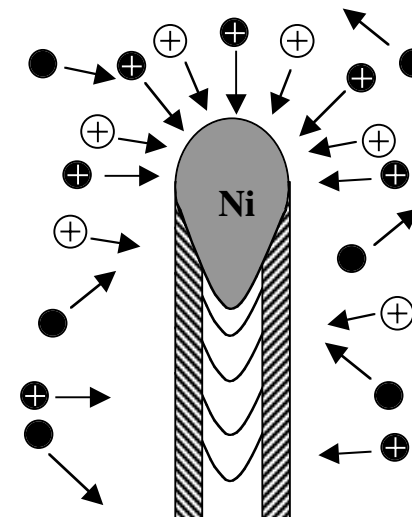
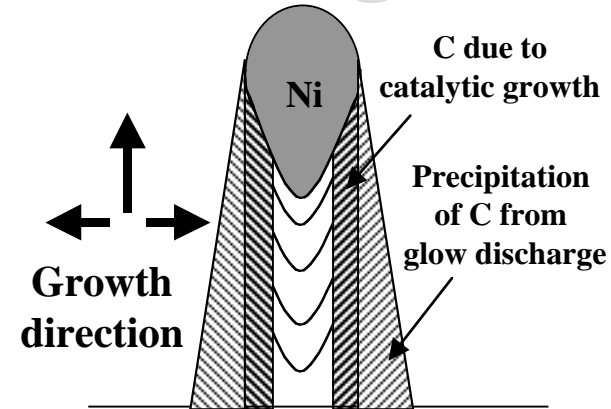


Nanofabrication enabled new insight

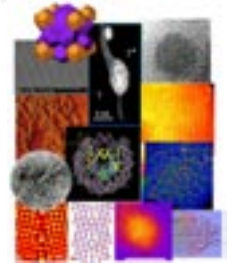
Growth from nano-patterned catalyst



Growth model



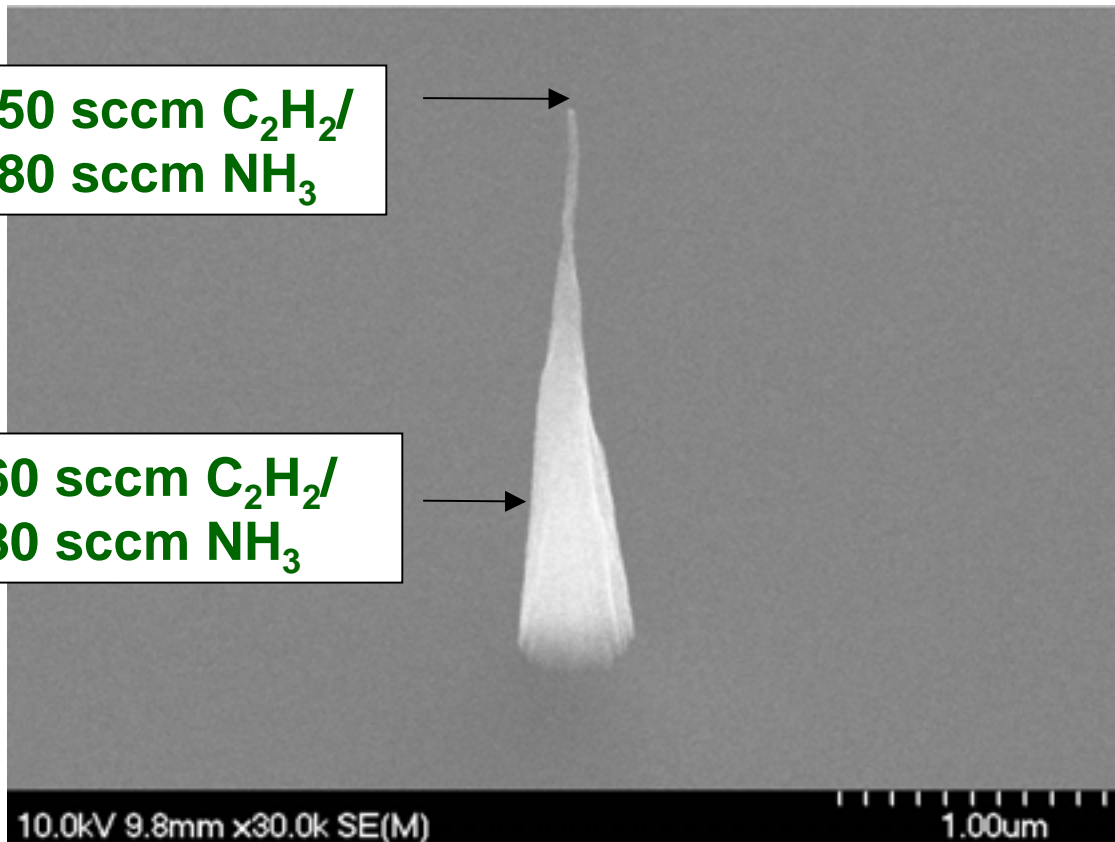
- - C neutrals
- ⊕ - C ions
- ⊕ - reactive etchant species



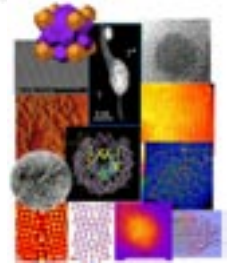
Result of new synthesis process insight: *controlled synthesis*

50 sccm C_2H_2 /
80 sccm NH_3

60 sccm C_2H_2 /
80 sccm NH_3



Merkulov, V. I. , M. A. Guillorn, D. H. Lowndes, M. L. Simpson, E. Voelkl, “Shaping carbon nanostructures by controlling the synthesis process”, *Appl. Phys. Lett.*, 79(8), August 20, 2001, 1178-1180.



Nanofabrication for the study of *interfaces*

From the DOE-BES Report Nanoscale Science, Engineering and Technology Research Directions

“.....primary objective should be the *Nanoengineering of the Biological Interface*”

