Lecture#1:

Overview of Micro/Nano Fabrication Process

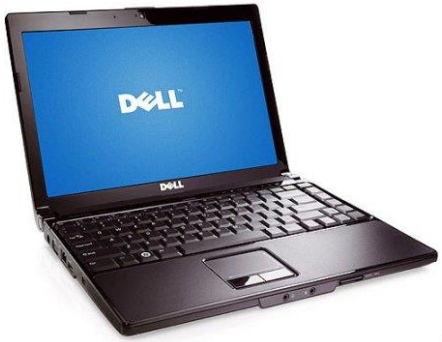
Overview

Introduction

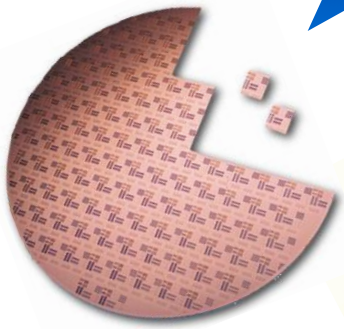
- **Micro/Nano World**

Semiconductor Supply Chain

Introduction



OEMs - End User Markets
- Samsung, Apple, Dell



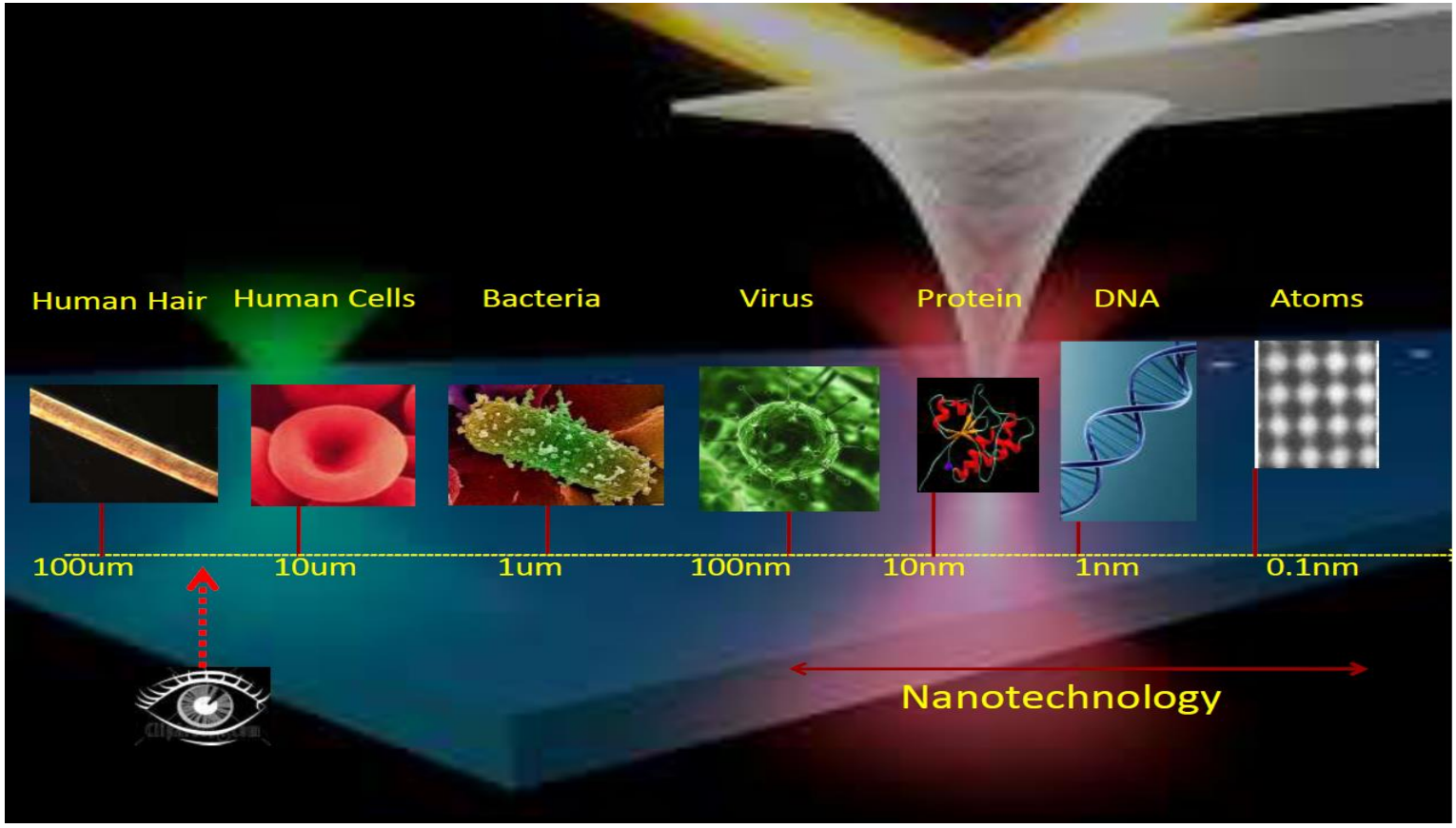
Semiconductor Device Manufacturers or Foundries
- Intel, Samsung, TSMC, SK Hynix, Micron, Qualcomm

Semiconductor Equipment Manufacturers
- Lam Research, Applied Materials, ASML, KLA-Tencor

What is Nanotechnology?

Introduction

Nanotechnology is the study of manipulating matter on an atomic and molecular scale. Generally, nanotechnology deals with structures sized between 1 to 100 nanometre in at least one dimension, and involves developing materials or devices within that size. (Wikipedia)



How can you make it?

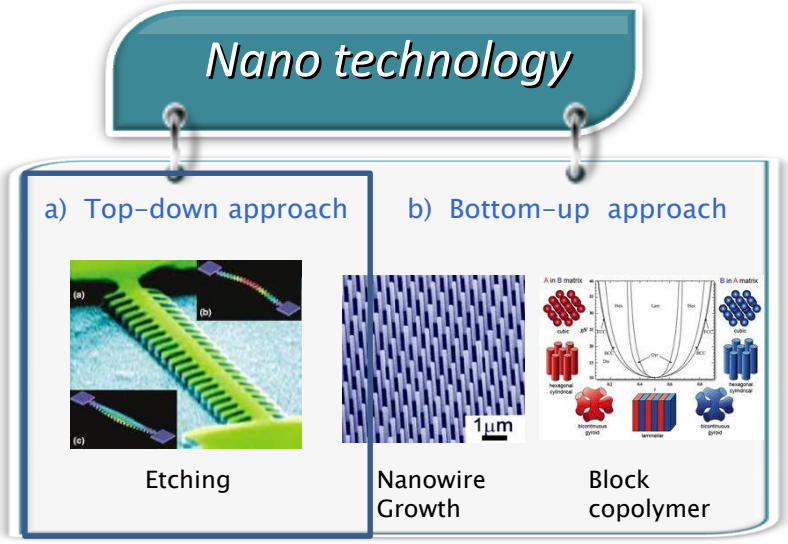
Introduction

Fabrication of structure

The statue is carved by chisel or hammer

Growth of flowers

Traditional method



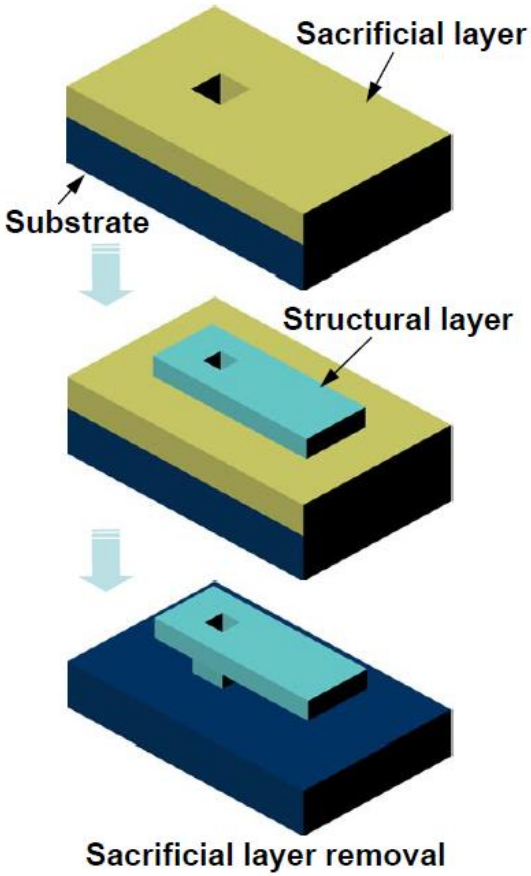
Traditional Method (Top-down approach: old)

Introduction

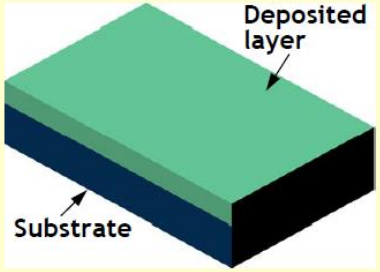
- **How did build up dolmens?**

Traditional Method (Top-down approach: current)

Introduction

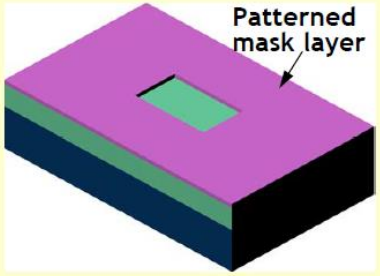


Deposition



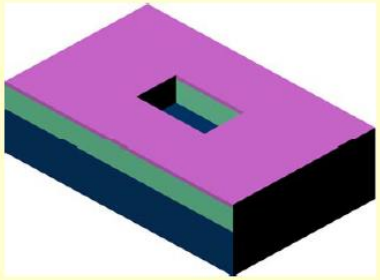
- CVD
- Coating
- Sputtering
- Evaporation
- Bonding
- Plating

Patterning



- UV lithography
  - Stepper
  - Contact aligner (Double side)
- E-beam lithography
- X-ray lithography

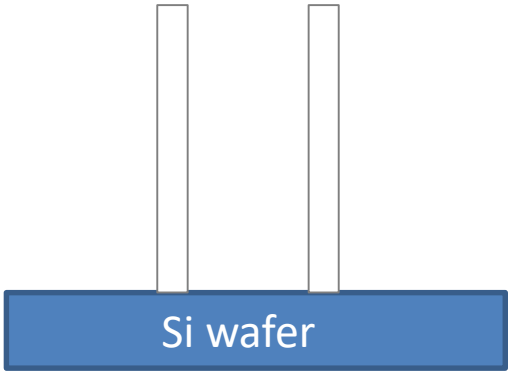
Etching



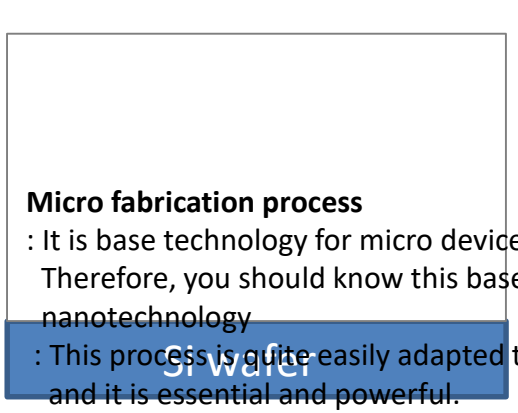
- Dry etching
  - Anisotropic
  - Isotropic
- Wet etching
  - Anisotropic
  - Isotropic

Traditional Method (Top-down approach: current)

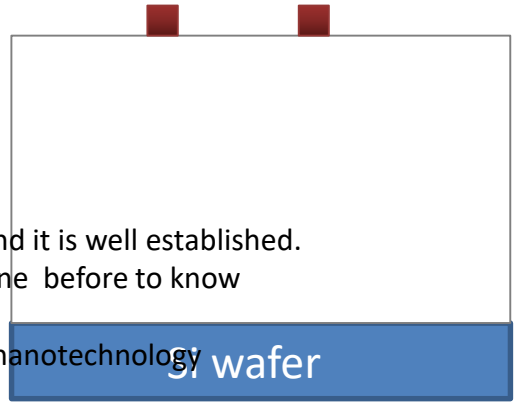
Introduction



Micro fabrication process
: It is base technology for micro device and it is well established. Therefore, you should know this base one before to know nanotechnology
: This process is quite easily adapted to nanotechnology and it is essential and powerful.

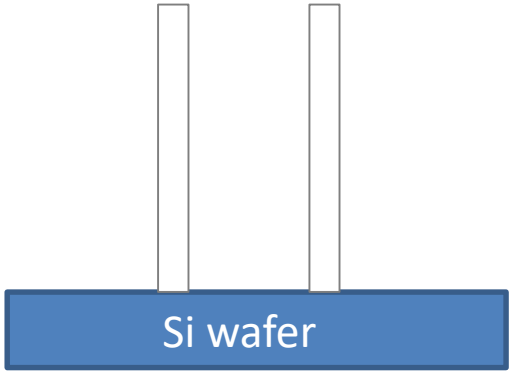


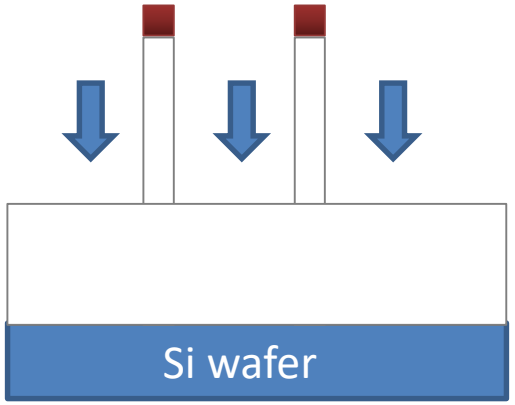
Deposition



Lithography

Base Technology





Etching

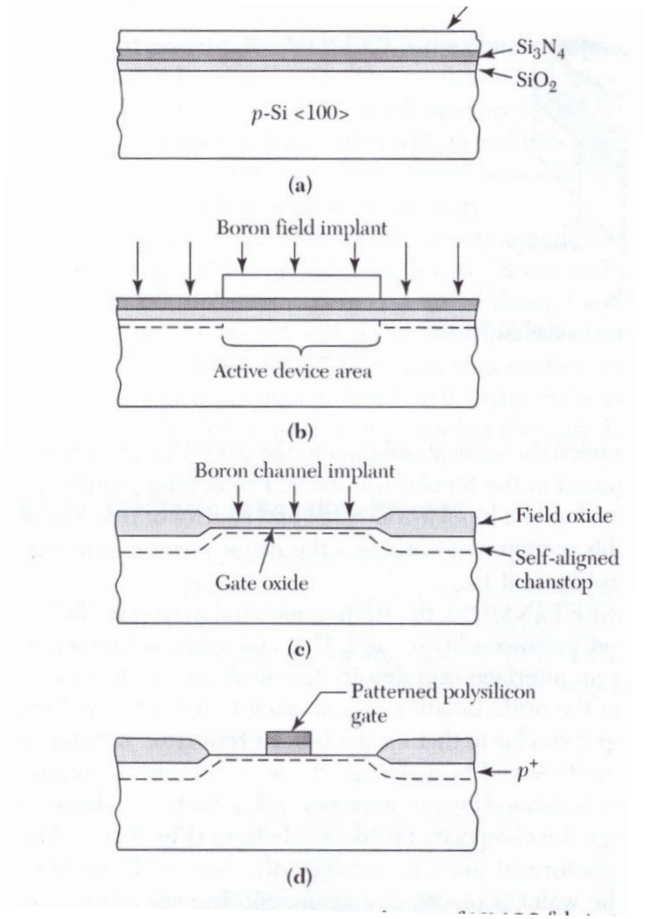
Target device

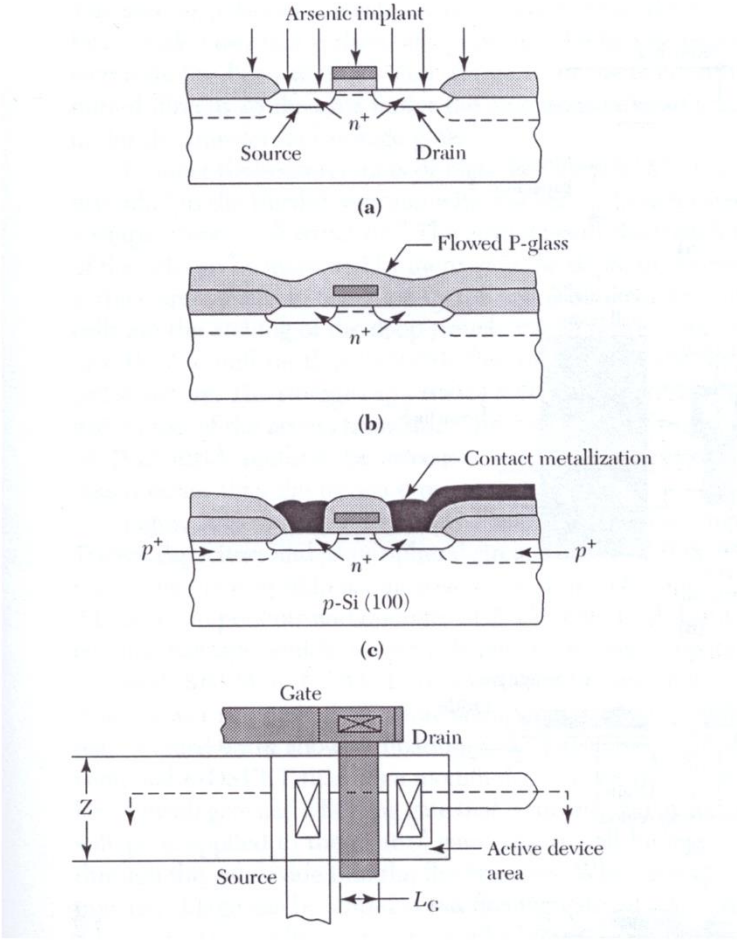
Introduction

- Transistor – Unit building block of memory, CPU, and even display

Fabrication Process

Introduction

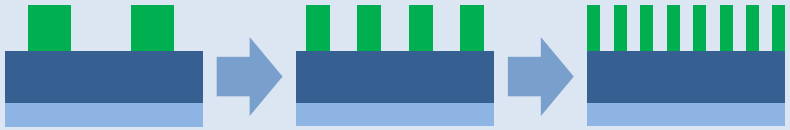




Innovation

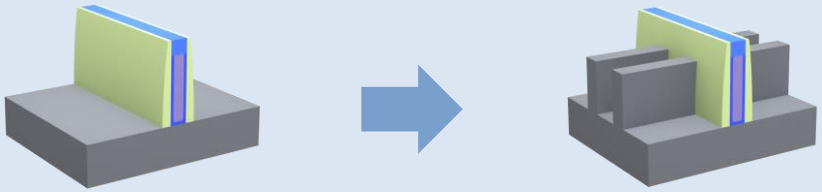
Introduction

Multiple Patterning



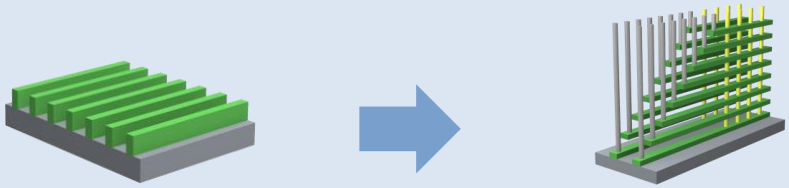
Higher density

FinFET Logic Gate



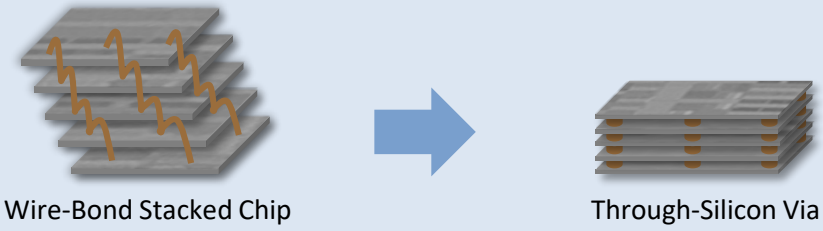
Higher speed, lower power

3D NAND



Higher density

Through-Silicon Via



Higher speed, lower power, smaller footprint

Syllabus

Introduction

Evaluation

- Class participation (10%) / Homework (15%) / Mid-term exam (30%) / Final exam (45%)

Plan

1. Overview of Micro/Nano fabrication process
2. Essential electrical concepts & basic structure of transistor
3. Lithography process
4. Oxidation process
5. Diffusion process
6. Etching (I)
7. Etching (II)
8. Mid-term exam
9. Thin film deposition (I)
10. Thin film deposition (II)
11. Ion implantation
12. Process integration (I)
13. Process integration (II)
14. Other processes
15. Applications
16. Final exam

Text book

- Main: “Fundamentals of Semiconductor Fabrication,” Gray S. May & Simon M. Sze
- Sub:
  “VLSI Technology,” Simon M. Sze
  “Handbook of thin film deposition process and technology,” Krishna Seshan
  “Micro-machined Transducers: Source Book," Kovacs
  “Introduction to Microelectronic fabrication,” R. C. Jaeger
  "Fundamental of Micro-fabrication," Madou

TA

- Jieun Lee (Integrated Ph.D. Student) / leeje1203@dgist.ac.kr

No class

- 3/1 Tue (Independence Movement Day)
- 5/5 Thu (Children’s Day)