Semiconductor Device Processing
(반도체 소자 공정 및 실습)

Lecture 1. Introduction

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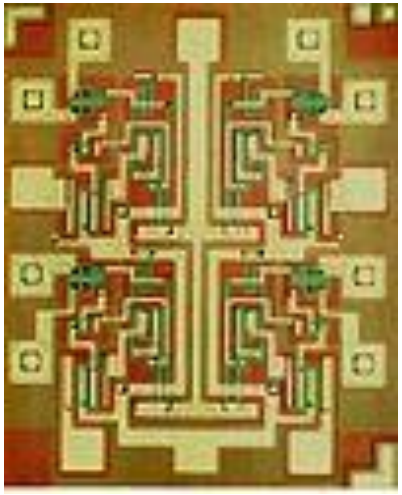
Semiconductor Device Processing

Wikipedia

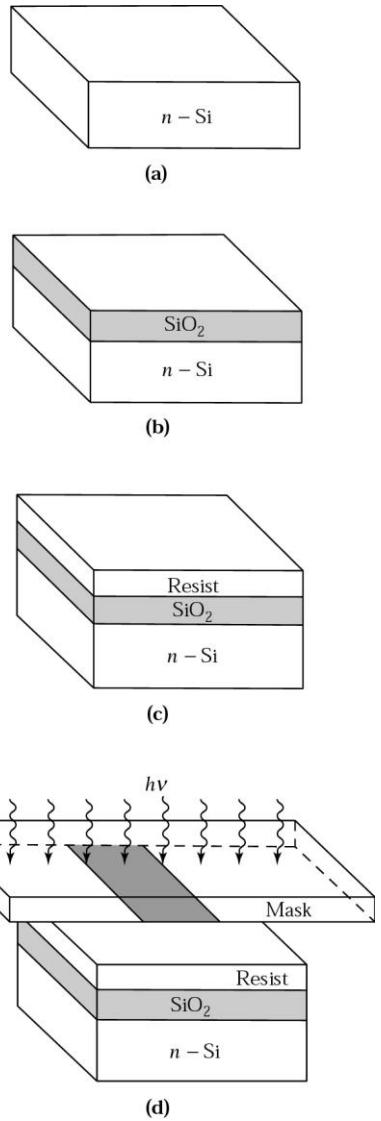
Semiconductor device fabrication is the process used to create the integrated circuits that are present in everyday electrical and electronic devices. It is a multiple-step sequence of photo lithographic and chemical processing steps during which electronic circuits are gradually created on a wafer made of pure semiconducting material. Silicon is almost always used, but various compound semiconductors are used for specialized applications. The entire manufacturing process, from start to packaged chips ready for shipment, takes six to eight weeks and is performed in highly specialized facilities referred to as fabs.



Prerequisites – Semiconductor Physics and Devices

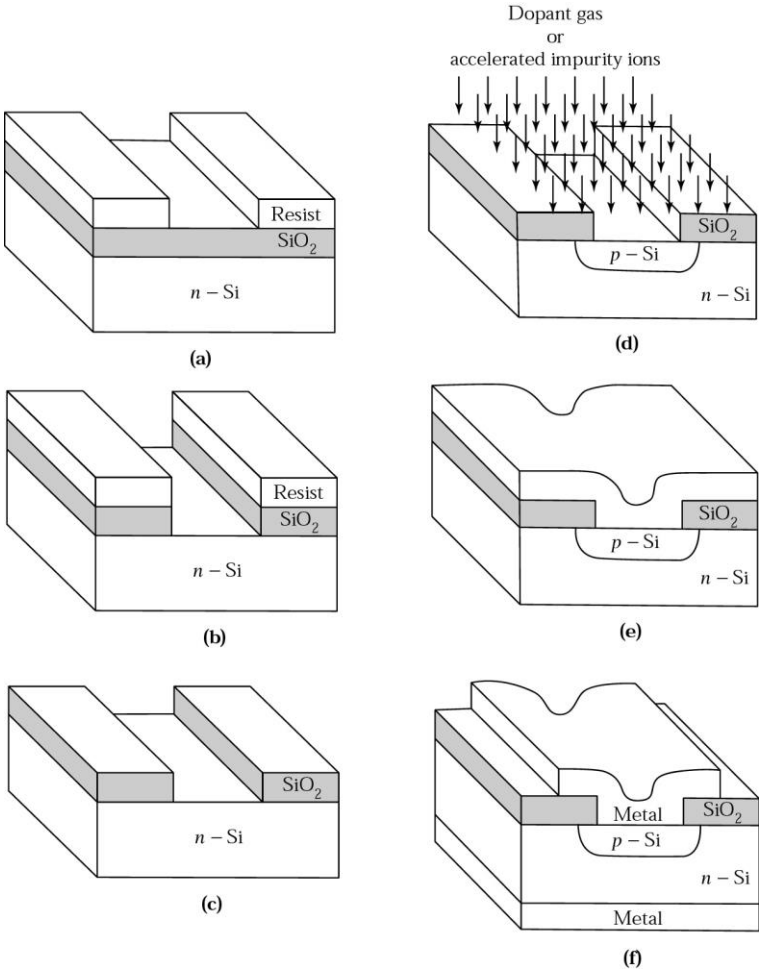
No textbook

Fabrication of a silicon PN diode



(*a*) A bare *n*-type Si wafer.
(*b*) An oxidized Si wafer by dry or wet oxidation.
(*c*) Application of resist.
(*d*) Resist exposure through the mask.

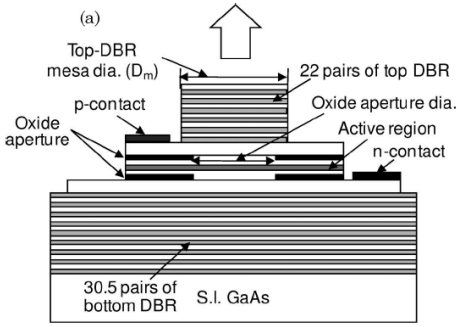
Fabrication of a silicon PN diode

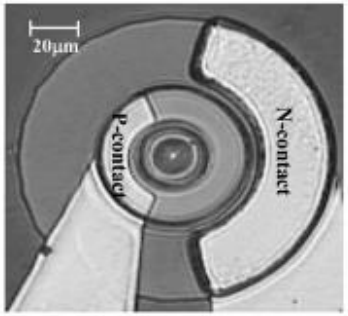


(*a*) The wafer after the development. (*b*) The wafer after SiO_2 removal. (*c*) The final result after a complete lithographic process. (*d*) A *p-n* junction is formed in the diffusion or implantation process. (*e*) The wafer after metallization. (*f*) A *p-n* junction after the complete processes.

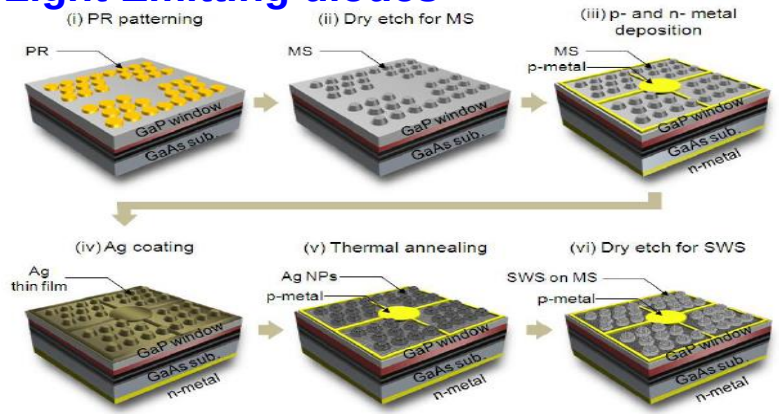
Examples of semiconductor devices/structures

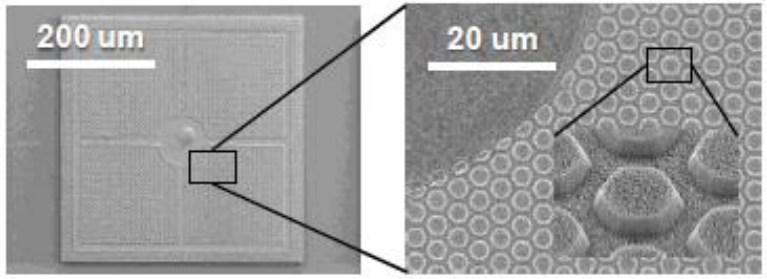
Laser diodes



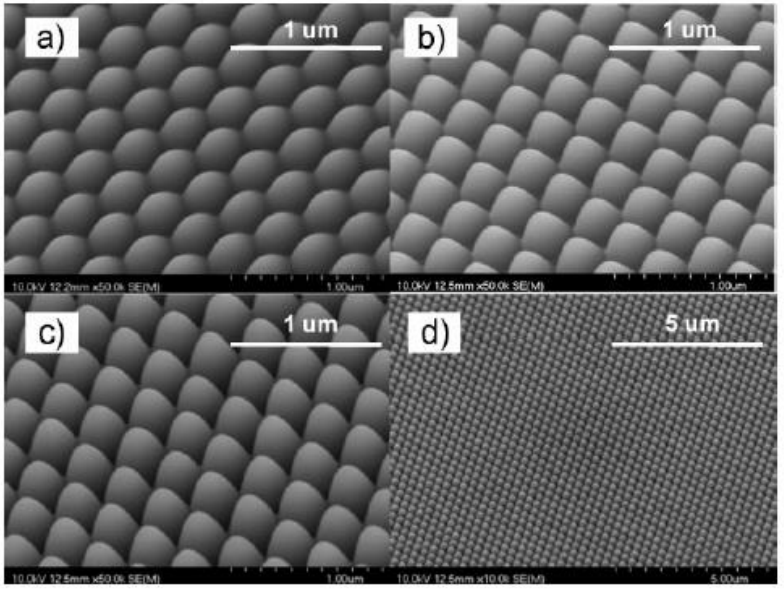


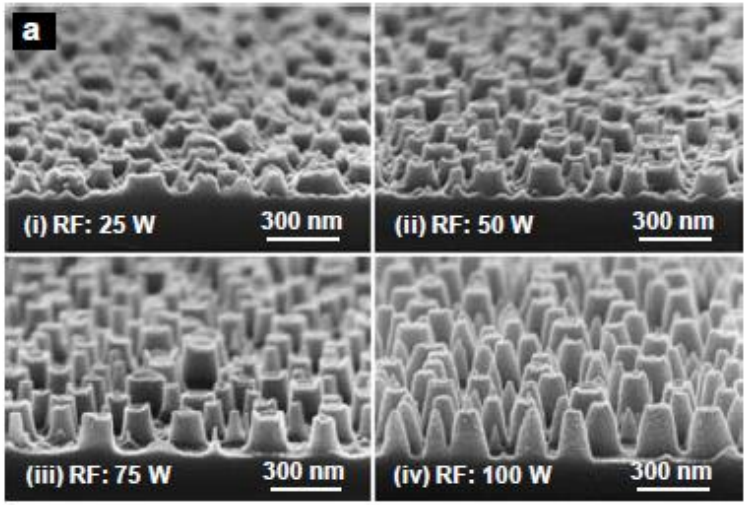
Light Emitting diodes





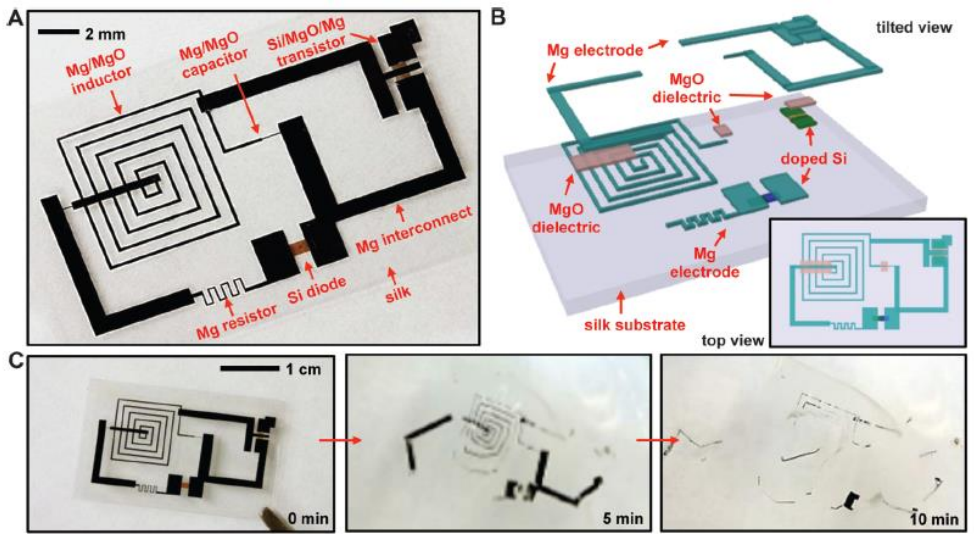
Nanopatterns

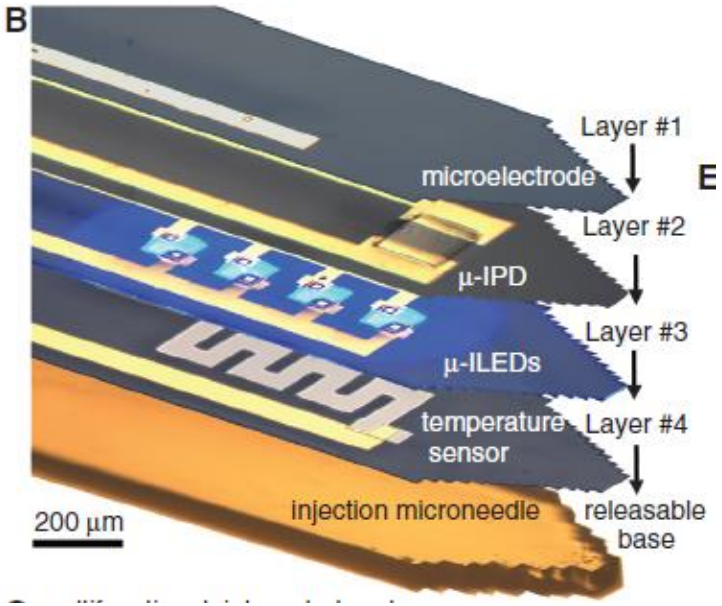


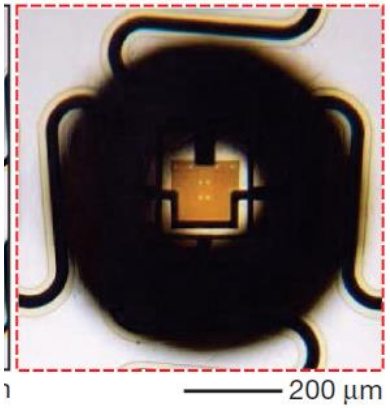


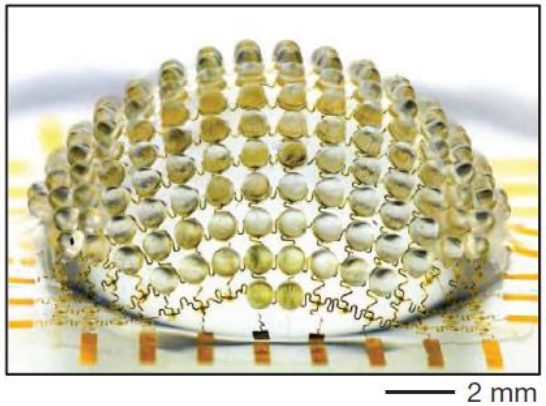
Examples of semiconductor devices/structures

Thin film devices









Course Schedule

Weekly Course Schedule		
Week	Description	*Remarks
1st	Introduction and safety training	Experiment
2nd	Growth and characterization of compound semiconductors	Experiment
3rd	Optical lithography	Experiment
4th	Metallization	Experiment
5th	Lift-off	Experiment
6th	Ohmic contacts of semiconductor devices	Experiment
7th	Sputtering of dielectric films	Experiment
8th	Mid-term exam	Experiment
9th	Thickness measurement of dielectric thin film	Experiment
10th	Wet etching of compound semiconductors	Experiment
11th	PECVD of SiO2 and SiNx film	Experiment
12th	Dry etching of dielectric films	Experiment
13th	Dry etching of compound semiconductors	Experiment
14th	Scanning electron microscopy	Experiment
15th	Measurement of Schottky diode characteristics	Experiment
16th	Final Exam	

‘Real’ Schedule

Weekly Course Schedule		
Calendar	Description	*Remarks
1st week	Introduction/Semiconductor Process Overview	Lectures
2nd week	Semiconductor Process Overview	Lectures
3rd week	Growth of compound semiconductors – MBE & MOCVD	Presentations
4th week	Photolithography / Nanolithography	Presentations
5th week	PECVD / Oxidation	Presentations
6th week	Dry etching / Cleaning & Wet etching	Presentations
7th week	Diffusion / Ion implantation	Presentations
8th week	Mid-term Week	No midterm
9th week	Metallization (Ohmic Contacts) / TLM measurement	Presentations
10th week	Fabrication & Measurement of TLM patterns	Experiments
11th week		Experiments
12th week		Experiments
13th week		Experiments
14th week		Experiments
15th week		Experiments
16th week	Final Exam & Final Report	

Lecture Notes

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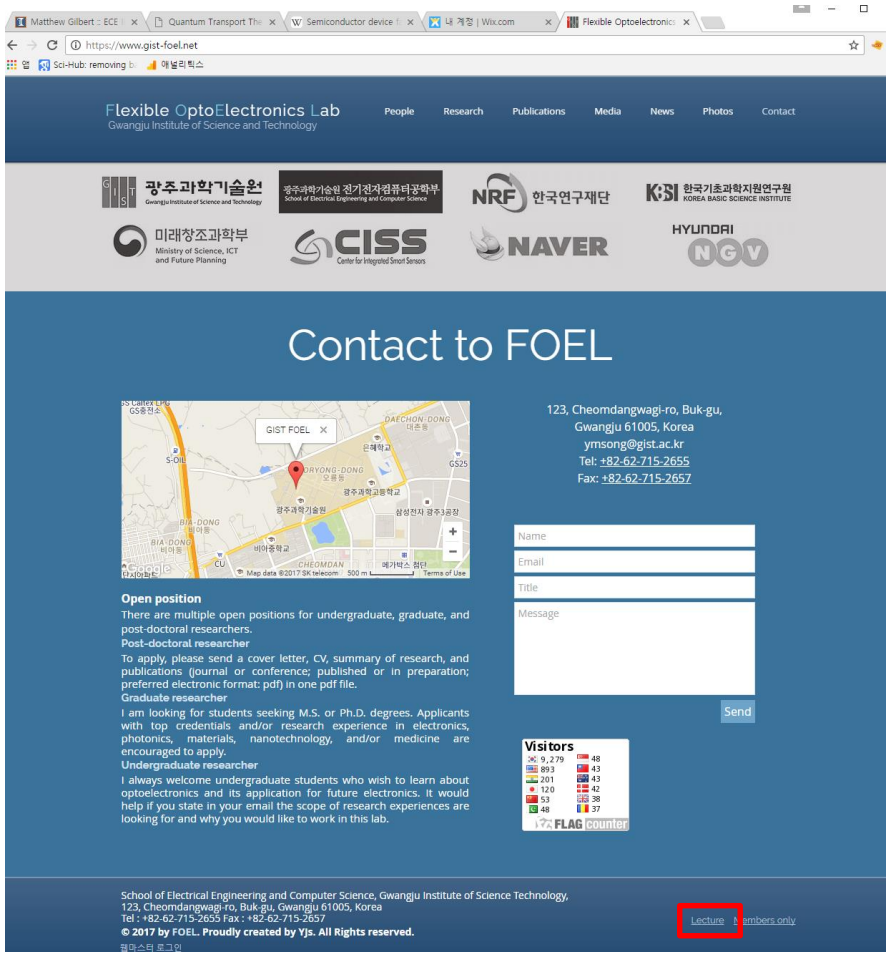

Lecture

Assessment and grading

Attendance (5%)

Presentations and pre-reports (30%)

→ 15 min presentation

→ Pre-report for 6 presentation topics (select one topic per week, ~3 pages)

Final report (30%)

Final Exam (35%)

Presentation Subjects

1
1. Molecular Beam Epitaxy (MBE)
2. Metal-Organic Chemical Vapor Deposition (MOCVD))

2
3. Photolithography
4. Nanolithography

3
5. PECVD
6. Oxidation

4
7. Dry etching
8. Cleaning / Wet etching

5
9. Diffusion
10. Ion implantation

6
11. Metallization
12. Transmission Line Measurement (TLM)

Question or Comment?