

EE 143

Microfabrication Technology

Fall 2006 - Lab Tutorial
September 1, 2006

Goal – I am here to:

- discuss the lab-works before you enter and work in the lab
- help you understand the lab better
- help you get a better grade on lab
- answer questions you have for previous and subsequent labs
- answer questions you have on lab reports
- in general, help you out

In order to achieve the above more successfully and effectively,
I want your feedback from time to time.

Day: Monday

Time: 4pm – 5pm

Place: will be confirmed later

Email: kinyip@eecs.berkeley.edu

O.H.: none, sent email to ask me questions, please

Material:

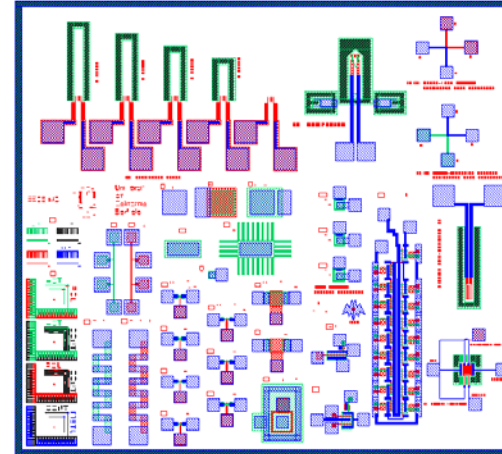
- slides, will be uploaded weekly
- lab manual, will be best if you've read them before coming

Week 2:

- brief intro to the lab
- chip layout & process flow
- safety, cleaning, chemical disposal rules
- a *virtual* tour to the lab

Intro:

- You learn the theories in class; you practice them in lab
- You are going to make resistors, diodes, MOS-cap bipolar transistor, MOS-transistor, ... some MEMS structures, like bimorphs, ...
- By the end of the semester, you should have learnt basic lab techniques how to operate some of the equipments how to characterize the devices you made



Process Flow:

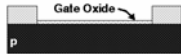
Week 2: Field Oxidation - 5200 Å



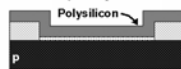
Week 3: Active Area Photolithography



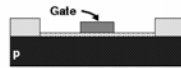
Week 4: Gate Oxidation - 800 Å



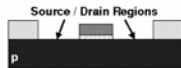
Week 5: Poly-Si Deposition



Week 6: Gate Photolithography

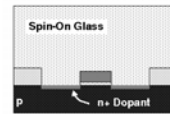


Week 6: Clear Source and Drain



Process Flow (cont.):

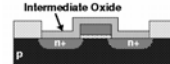
Week 7a: Source-Drain Deposition (N+)



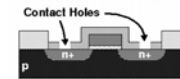
Week 7b: Spin-on Glass Strip



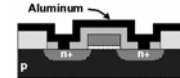
Week 7c: Drive-In Oxidation



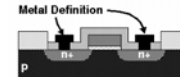
Week 8: Contact-Hole Cut (Mask #3 - CONT)



Week 9: Metallization



Week 10: Metal Definition



Cleaning:

- only enter the clean room fully gowned
hair net + lab coat + glove + shoe net + safety goggle
- do NOT touch chemicals / equipments with bare hand
- always handle wafers with tweezers and trays (unless told otherwise)
- wash hand before and after entering the lab (why??)
before: so not to contaminate wafers or equipment
after: avoid chemicals being indigested
- Next week, GSIs will demonstrate how to clean up masks
- 4th week, GSIs will demonstrate how to piranha-clean wafers

**Safety:**

- do NOT enter the lab when GSI aren't present, under all conditions
 - know all the emergency exits (ask the GSIs to show you)
 - know where to find the MSDS
under the whiteboard in characterization room
 - know where to find the closet water sources, shower, eye wash
 - ask whenever not clear
 - do NOT try things out without permissions
 - NO eating, drinking, playing, ... inside the lab
- Things in the lab can be dangerous if not carefully handled. Be sure to respect the chemicals.

**Safety: Chemical Handling**

- wear protective gears when handling corrosive chemicals
face shield, chemical apron, chemical glove
respirator if necessary
- check glove for holes
blow with N₂, then submerge in water
- check pH of unknown spillage, label everything
- corrosive chemicals: H₂SO₄, HF, aluminum etch, TMAH
- wash and rinse the exposed part with water for > 15mins
- add acids to water, not the other way around (why??)
potential spilling if add water to acid
- handle wet chemicals only at sinks, acid on right, others on left side

Safety: Chemical Handling

- HF: be very very careful, can be deadly
when you feel it, it is attacking you bone
will keep eating your bone, without being consumed
apply calcium gluconate if exposure is suspected
use only plastic beakers for HF (why??)
- H₂SO₄: should be very painful, severely burnt when in touch
add H₂O₂ to H₂SO₄ to prepare piranha
do not carry the beaker around after mixing (HOT!!)
use only glass beakers for piranha (why??)



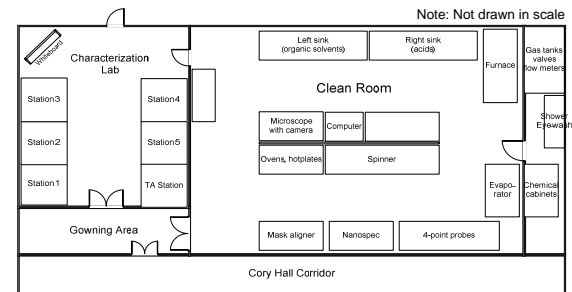
Chemicals used in the lab are harmful one way or the other. Don't breathe and avoid exposure if possible.

Use teflon-wares when handling wafers in acids. Be careful, those teflon tweezers do not hold the wafers very well!!

Safety: Chemical Disposal

- water-soluble chemicals should be aspirated
- organic chemicals are discarded in designated container however, in this lab, photoresist (PR) are also dumped down the drain.
- do NOT mix organic wastes with acids (why??) can cause fire or even explosion
- do NOT mix acids and bases
- when needed to aspirate acid, bases, organic solvents, aspirate a beaker of water as buffer

Lab Floor Plan:



If time allows, you can ask your GSI to show you the clean room!

Next Next Week:

- discuss what you have to in the lab
- briefly go over how to operate the spinner and mask aligner
- review how to handling and drying wafers
- review rules of handling acids

Week 3: Active Area Photolithography

