1) In addition to clean air → chemicals used in microfabrication must be of high purity → expensive

→ water → must be "deionized" → ions in water migrate into Si and other materials, contaminating them

→ called DI-water

→ tap water resistivity ~ 150kΩ-cm

DI-water resistivity ~ 18 MΩ-cm

note text book has error in units

2) <u>MEMS Fabrication on Silicon</u>

→ Grew out of IC microfabrication → on Si wafers

a) Making a Si wafer

Si melts at 1414°C

① <u>CZ Method</u> → Czochralski Method

→ small seed crystal of a preselected orientation

→ inserted into melted high purity Si → in a crucible

→ while the crucible is turned, the seed is drawn out

→ the molten Si crystallizes on the seed in the same crystal orientation as the seed

→ the resulting tube of Si is called a boule

② <u>FZ Method</u> → Float Zone Method

→ uses a seed crystal and a polysilicon rod

→ RF heater creates a local melted zone that is dragged along the rod from end to end

→ the Si in the melted zone recrystallizes as to match the Si seed's orientation

③ the resulting Si boule or rod <looks like a bologna> is cut into thin wafers using a diamond saw

→ the wafers are polished on one or both sides

→ various size wafer are available

<u>diameter</u>

50 mm ~ 2"

75 mm ~ 3"

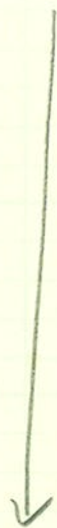
100 mm ~ 4"

125 mm ~ 5"

150 mm ~ 6"

200 mm ~ 8"

300 mm ~ 12"



increasing thickness

100 mm wafers → ~500 μm thickness is common

→ current preferred thickness in AU microlab

3) <u>Photolithographic patterning</u>

→ <u>definition</u>: the process of transferring an image to a photosensitive layer, and specifically a binary pattern

→ the binary pattern is realized on a glass mask using transparent regions and opaque regions (plated Cr on the glass) → called a photolithography mask

→ a thin layer of photosensitive material, called photoresist → "PR", is uniformly applied to one surface of the Si wafer

→ the photolithography mask is brought into contact with the PR layer (contact lithography)

→ a collimated light source of sufficient wavelength and power is shined onto the mask/PR/wafer stack.

→ the light causes a chemical reaction in the PR not blocked by the opaque mask pattern

→ During developing, either

① exposed PR washes off → "positive PR"

② unexposed PR washes off → "negative PR"

→ Positive PR results in PR pattern that matches the mask pattern

→ Negative PR " " PR pattern that is a negative image of the mask pattern

→ Result → areas without PR on the wafer can be affected by additional processes, such as etching

→ Photolithography mask patterns are drawn using CAD tools