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 textbook has error in units

2) MEMS Fabrication on Silicon
   → Grew out of IC microfabrication → on Si wafers
   a) Making a Si wafer
      0 CZ Method → 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
      0 FZ Method → 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 wafers are available

\[
\begin{align*}
50 \text{ mm} & \sim 2'' \\
75 \text{ mm} & \sim 3'' \\
100 \text{ mm} & \sim 4'' \\
125 \text{ mm} & \sim 5'' \\
150 \text{ mm} & \sim 6'' \\
200 \text{ mm} & \sim 8'' \\
300 \text{ mm} & \sim 12'' \\
\end{align*}
\]

- increasing thickness

100 mm wafers \( \sim 500 \text{ pm} \) thickness is common

- current preferred thickness in AU microlab

3) Photolithographic patterning

- definition: 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, 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 a 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.