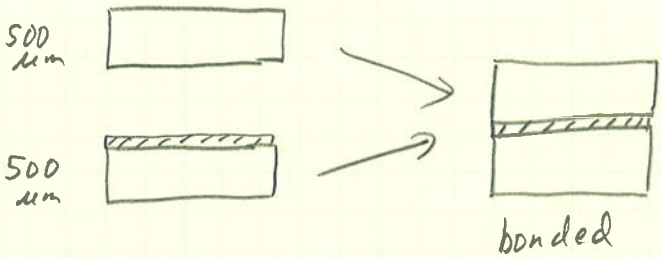
② High temperature bond the oxidized wafer to a second Si wafer:



③ CMP one of the wafers to a desired thickness (0.5 to 500μm)

Thinned Si layer → called "Device Layer"

SiO_2 layer → called "Box Layer"

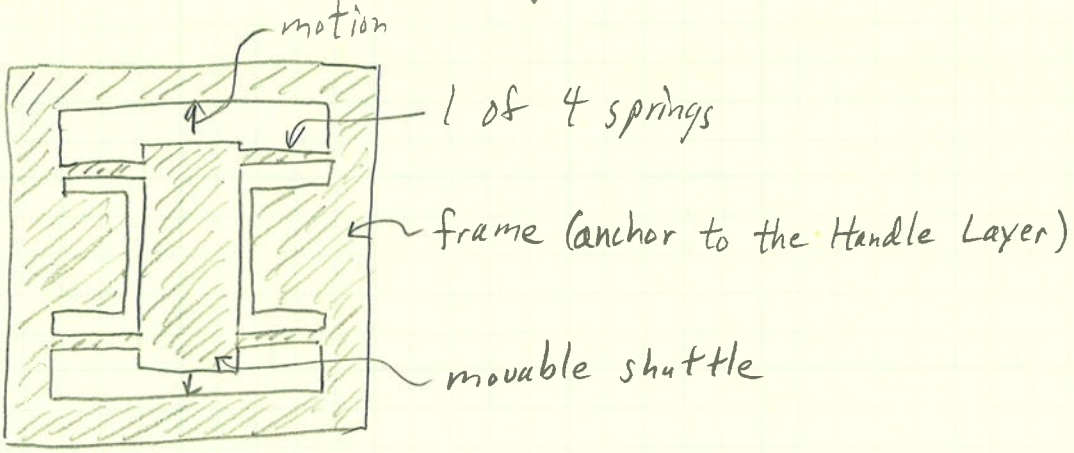
↳ Box → "Buried Oxide"

Thick Si layer → Handle Layer

a Often used with a 1 mask fabrication process to realize MEMS Devices with lateral moving structures

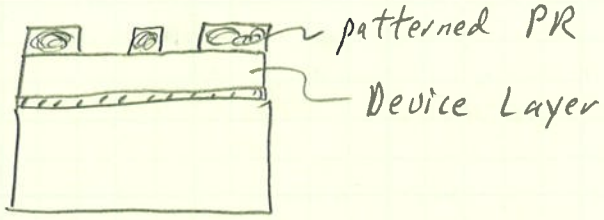
Example

Design →



1. SOI MEMS fabrication Process

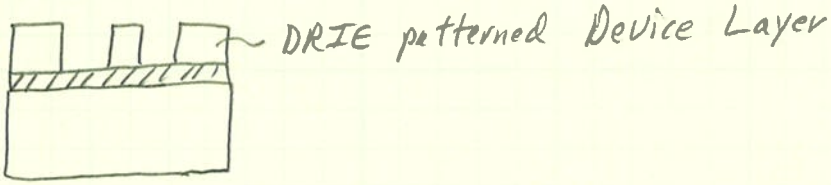
① Photolithography on Device Layer



② DRIE to Box Layer

→ A lower frequency DRIE process needed when etching stops on a buried oxide layer to prevent charge build-up resulting in lateral etching of Si sidewalls

→ remaing PR and sidewall polymerization are then removed



③ Wafer is Diced

④ Timed HF etch to remove Box Layer from under moving Device Layer structures, but not under anchor structures

→ called the "Release Etch"

⑤ HF replaced with another no-reactive liquid (such as ethanol). Using a pressure chamber, ethanol is replaced with liquid CO_2, which is frozen and then sublimated (solid to gas)

→ prevents released structures being pulled into contact with the Handle Layer due to surface tension of an evaporating liquid. This fabrication process uses Critical Point Drying CPD or Triple Point Drying (TPD)

3. Surface Micromachining Considerations

① Materials Issues

→ adhesion between layers

→ temperature compatibility i during deposition and CTE

→ sufficient etchant selectivity

② Intrinsic Stress in thin films

→ tensile or compressive

→ can result in warpage, tearing, delamination

③ Stiction

→ "STatic frICTION"

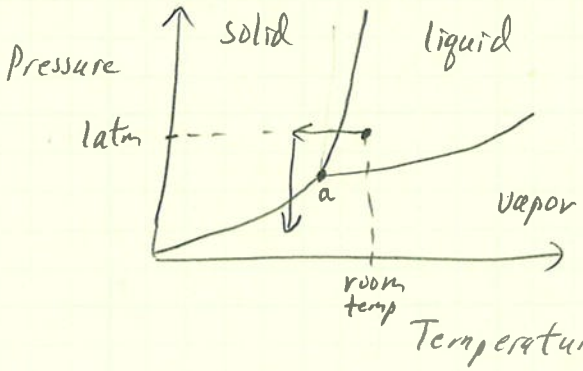
→ "STICking + fricTION"

→ surface forces can be significant in the micro-world resulting in permanent bonding when two micro structures come into contact

→ Particularly problematic with liquid release etches due to surface tension

Possible Solutions

i. Triple Point Drying



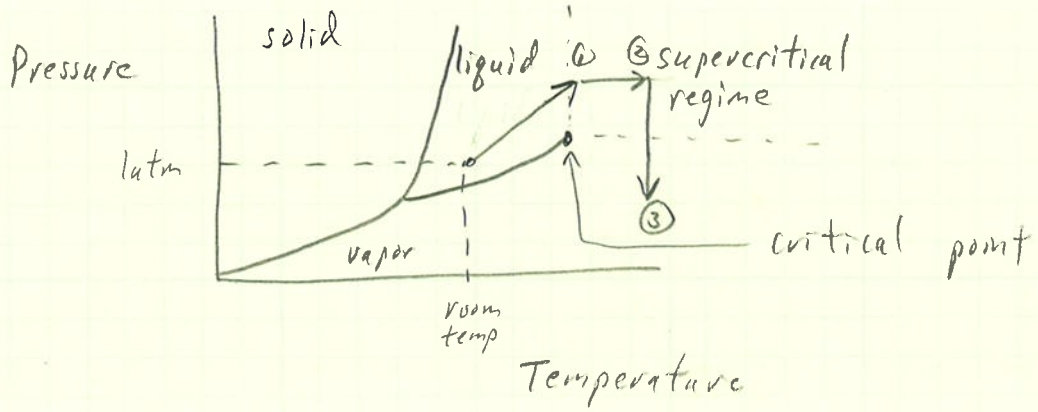
a → triple point

ex: water → ice → vapor

liquid → solid → gas

freezing ✓ sublimation ✓ → no surface tension issues

ii. Critical Point Drying (CPD)



supercritical fluid to vapor transition has almost no surface tension

iii. Antistiction coatings deposited on the structure