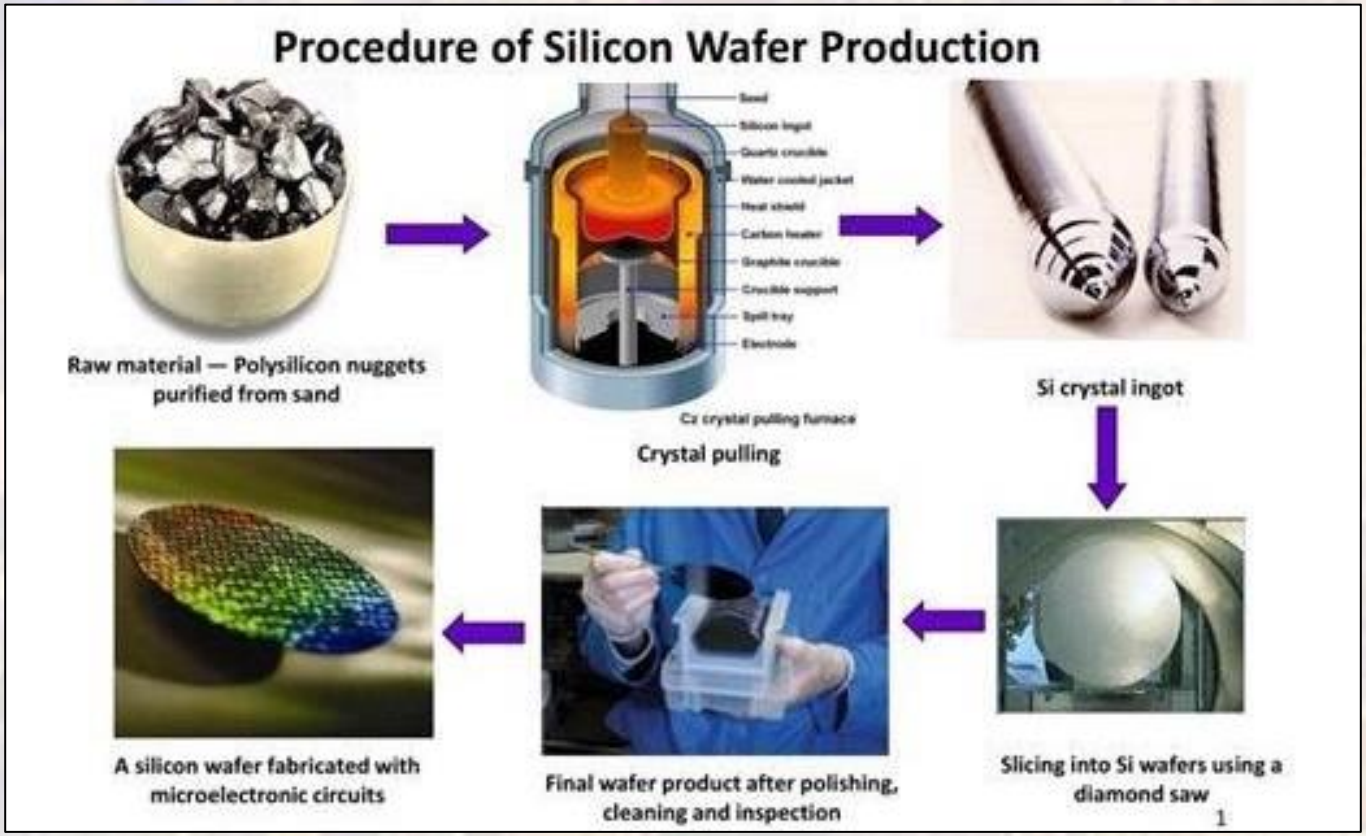
Integrated Circuit Processes

Last updated 7/10/23

IC Processes

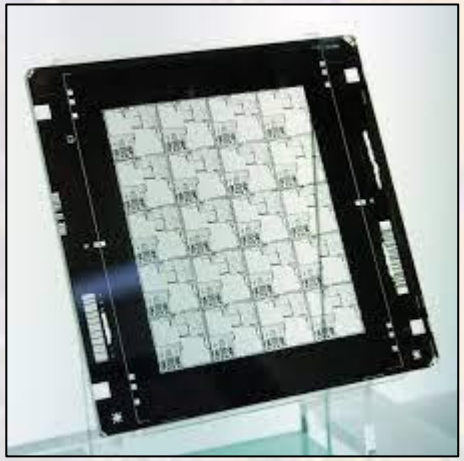
- Wafer Creation



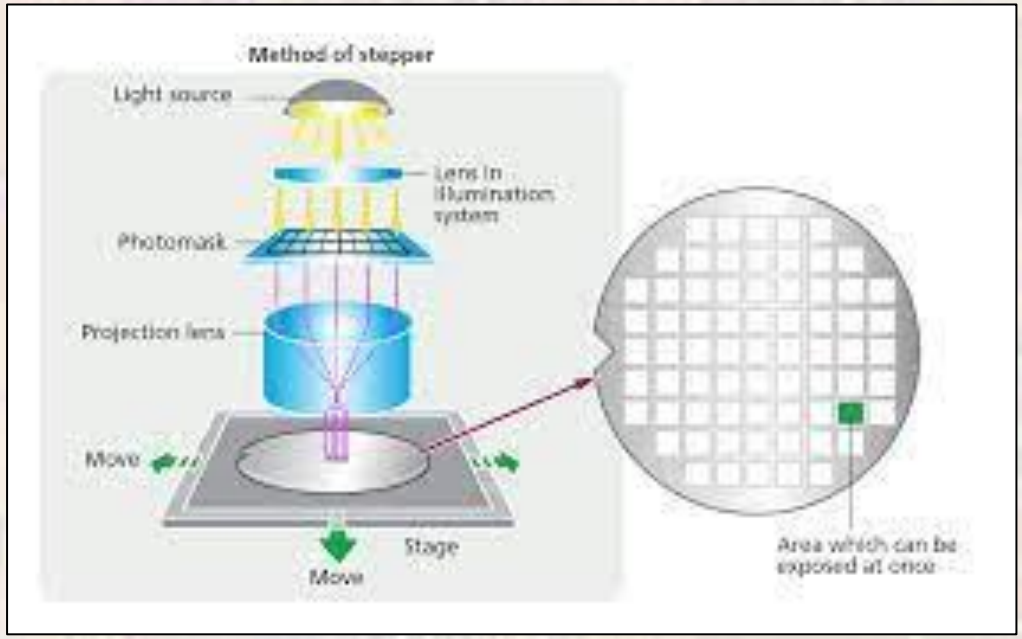
Src: AZoM

IC Processes

- Photomask
  - Glass (reticle) with a pattern formed on it with a light blocking material (chrome)
    - Stepped across a wafer to make multiple copies of the pattern
    - Used to block light from hitting the photoresist



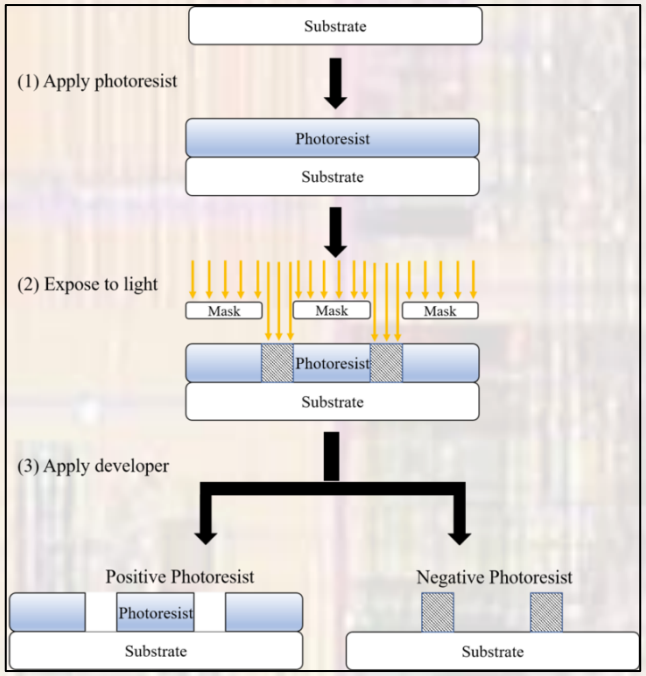
Src: wikipedia



Src: Nikon

IC Processes

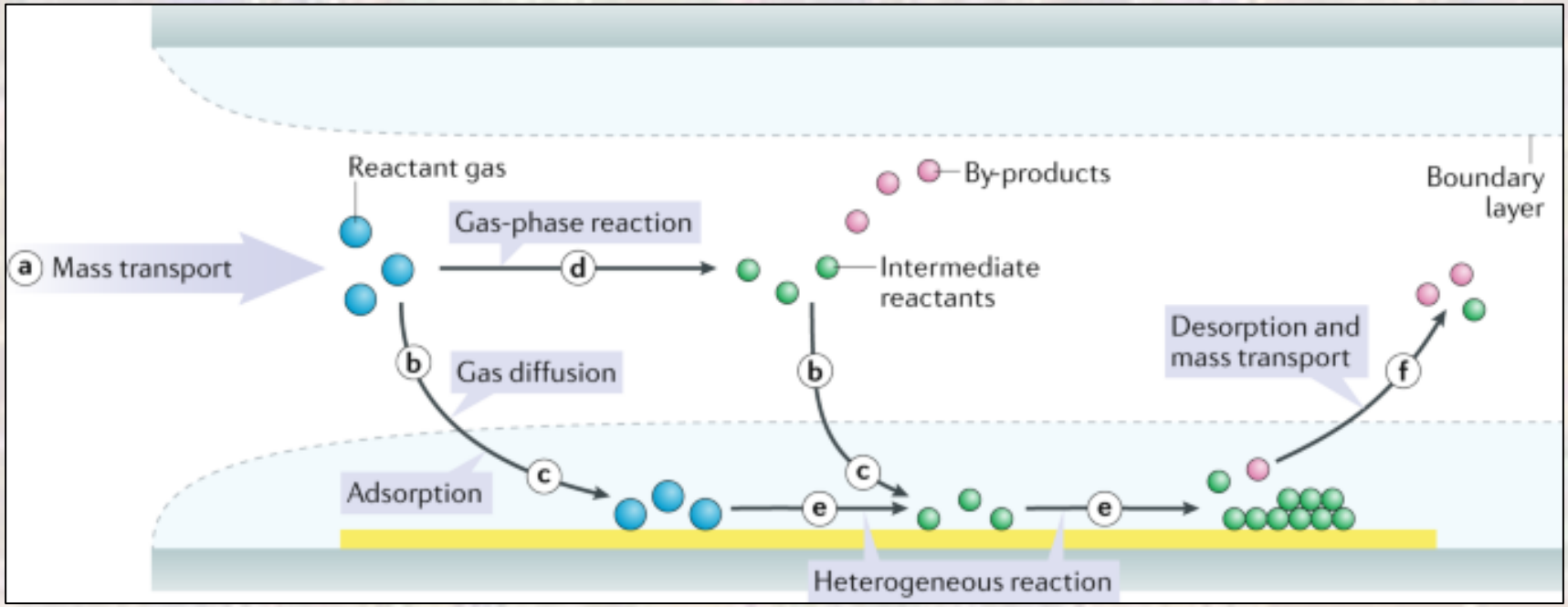
- Photoresist
  - Transparent coating that changes state when light is shined on it (UV)
    - Positive Resist – becomes soluble in developing agent (washes away)
    - Negative Resist – becomes in-soluble in developing agent (stays put)



Src: wikipedia

IC Processes

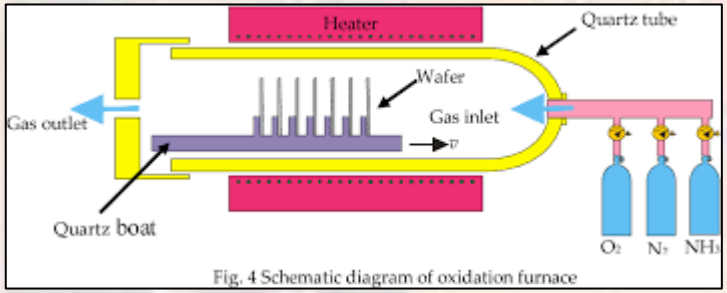
- Chemical Vapor Deposition (CVD)
  - Deposit layers of a molecule on a surface



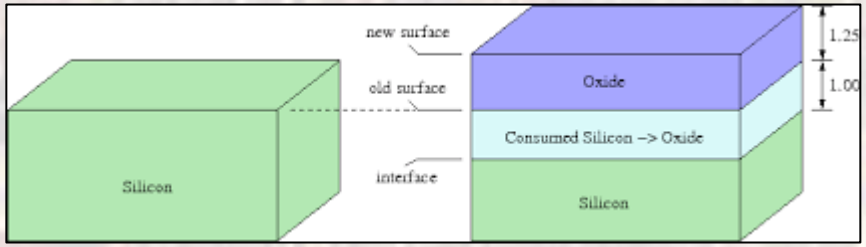
Src: Nature

IC Processes

- Oxidation
  - Grow SiO_2 from existing silicon and oxygen
    - Some of the original Si is consumed in the process



Src: Semantic Scholar

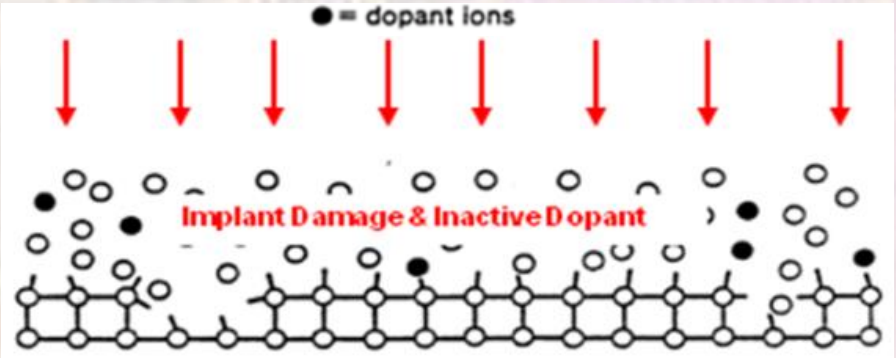


Src:.iue.tuwien.ac.at

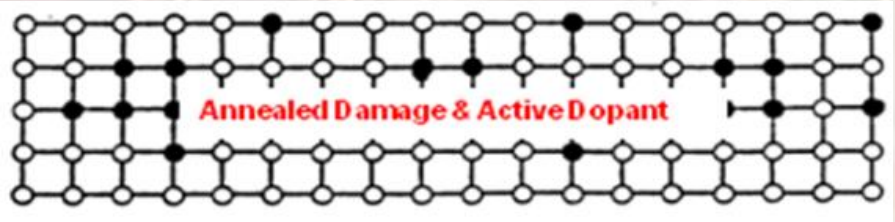
IC Processes

- Ion Implantation
  - Molecules are “shot” at a target (surface) with high energy
    - Molecules become embedded in the target material
    - The target material is damaged in the process
  - The target is heated to allow the target to anneal
    - Thermal energy allows the target molecules to re-align

Implantation



Anneal

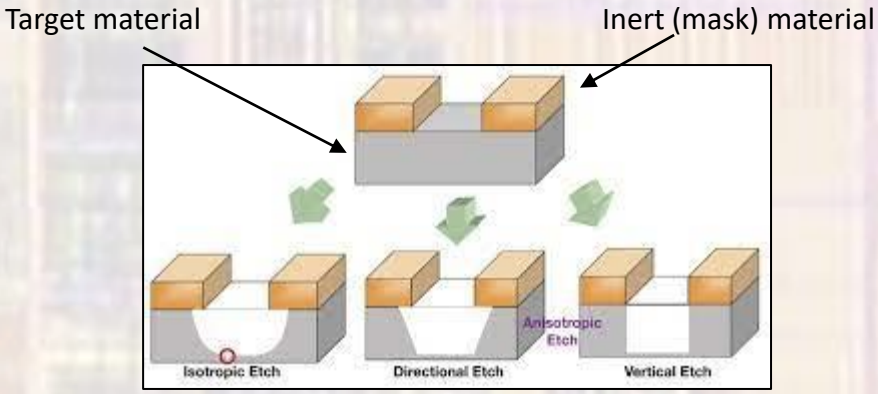


Src: IntechOpen

IC Processes

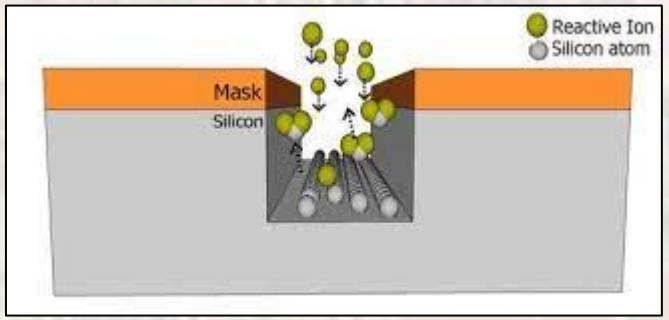
- Etching
  - Removal of a specific (target) molecule using
    - Wet (chemical) etching – chemical process to free up and wash away molecules
    - Dry (plasma) etching – ions are "shot" at the surface under a vacuum. Ions combine with the target material and are carried away

Wet etch



Src: MKS Instruments

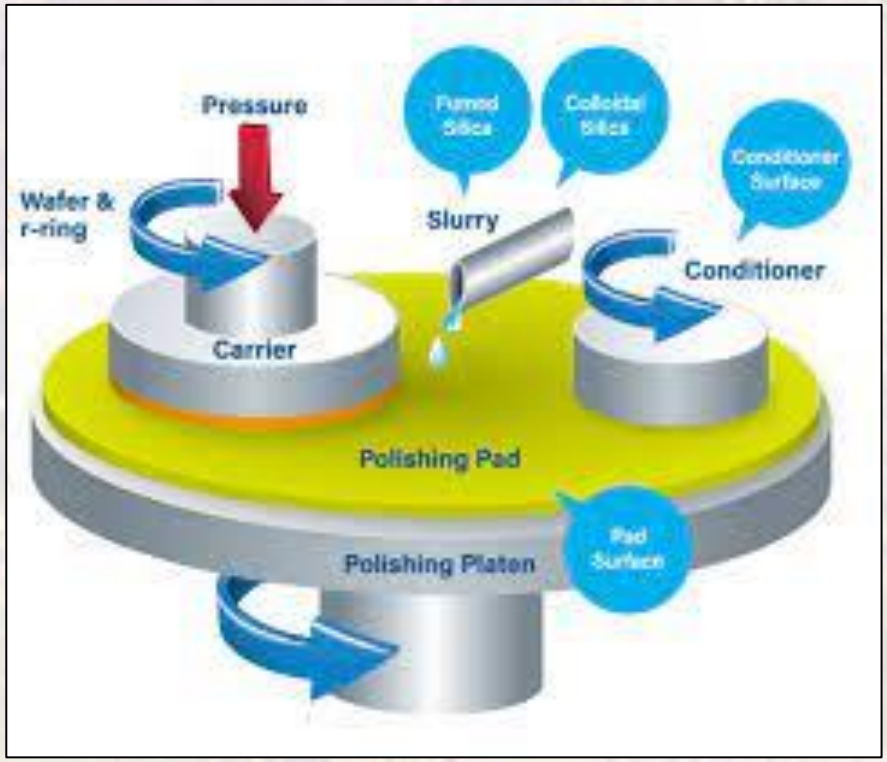
Dry Etch



Src: UC Davis

IC Processes

- Planarization
  - Flatten the surface of a wafer prior to further processing
    - Especially important prior to metallization
    - Can be used on the back side to thin the wafer



Src: HORIBA

IC Processes

- Clean Room
  - Room with highly cleaned surfaces and air to minimize particles that can settle onto a semiconductor wafer
    - Bunny suits required !
    - Wafers rarely (never) touched by humans – all robotics

Src: TurboFuture