Integrated Circuit Devices

NMOS

PMOS

Resistor

Capacitor
Starting Material

1. Si seed
   - pull
   - rotate
   - Si melt

2. Zone melting purification
   - 000
   - 000

3. Silicon wafer
   - p-
   - (p-type)
Lithography

alignment markers

wafer

mask

lens

pattern from layout

wafer top after development

photo resist

Si
Furnace

- Diffusion
  Eq. $2PH_3 + 4O_2$

- Oxidation
  Eq. $H_2O$ or $O_2$

- Chemical Vapor Deposition
  Eq. $SiH_4$

- Annealing
  Eq. $N_2$
Etching

plasma Etch

ions
reactive sass
water

resist
poly

SiO₂

Si

wet etch

resist
poly
under etch
resist
poly

SiO₂

Si
Ion implantation

ion source

slit
lens
accelerator
X-Y deflection
water

Metal Deposition

\( e^- \) beam

Al

wafers