Wafer Preparation
&
Fabrication

Czochralski (CZ) method....

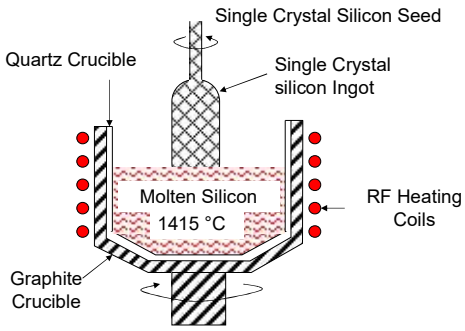
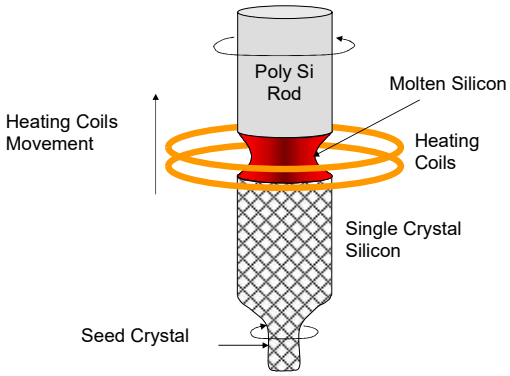


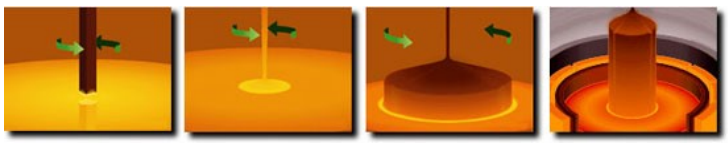
Figure 3.8 Czochralski crystal-growing system.

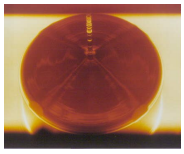
Float Zone Method

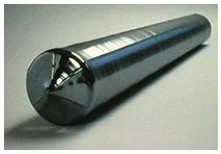


3

CZ Crystal Pulling







Source:
http://www.fullman.com/semiconductors/_crystalgrowing.html

4

Wafer Preparation…….

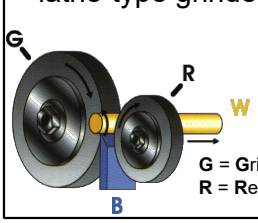
- End cropping
- Diameter grinding
- Crystal orientation, conductivity, and resistivity checking
- Grinding orientation indicators
- Wafer slicing
- Wafer marking
- Rough polishing
- Chemical mechanical polishing
- Backside processing
- Double-side polishing
- Wafer evaluation
- Oxidation
- Packaging

End cropping

After removal from the crystal grower, the crystal goes through a series of steps that result in the finished wafer. First is the cropping off of the crystal ends with a saw.

Diameter grinding

During crystal growth, there is a diameter variation over the length of the crystal. Diameter grinding is a mechanical operation performed in a in a centerless grinder. This machine grinds the crystal to the correct diameter without the necessity of clamping it into a lathe-type grinder with a fixed center point—although lathe-type grinders are used.



G = Grinding wheel
R = Regulating wheel

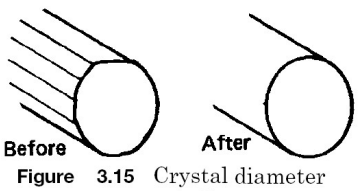


Figure 3.15 Crystal diameter grinding.

Crystal orientation, conductivity, and resistivity check

The crystal orientation (Fig. 3.16) is determined by either X-ray diffraction or collimated light refraction. X-rays or collimated light reflected off the crystal surface falls onto a photographic plate (Xrays) or screen (collimated light). The pattern formed on the plate or screen is indicative of the crystal plane .

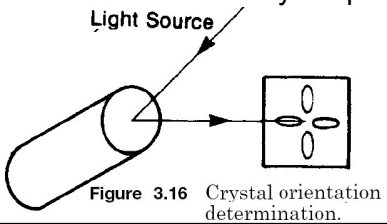


Figure 3.16 Crystal orientation determination.

Grinding orientation indicators

A ***flat***, called the major ***flat***, is ground along the axis. The ***flat*** functions as a visual reference to the orientation of the wafer.

A second, smaller, secondary ***flat*** is ground on the edge. The position of the secondary ***flat*** to the major ***flat*** tells the orientation and conductivity type of the wafer.

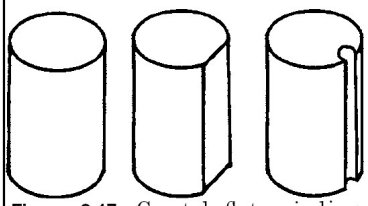


Figure 3.17 Crystal flat grinding.

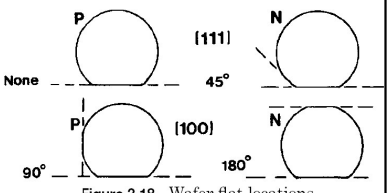
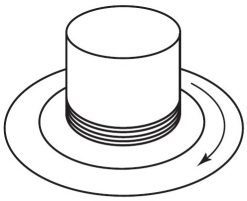


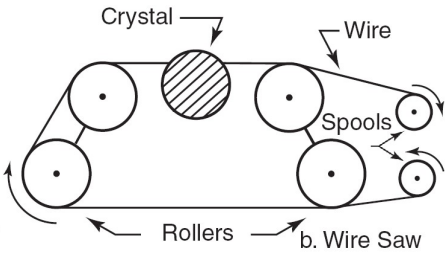
Figure 3.18 Wafer flat locations.

Wafer Slicing

The wafers are sliced from the crystal with the use of diamond-coated inside diameter saws (Fig. 3.19). For 300-mm diameter wafers, wire saws are used to ensure flat surfaces



a. Inside Diameter Diamond Saw



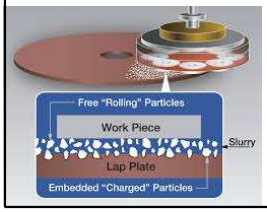
Wafer polishing

Rough Polish

Rough polishing is a conventional abrasive slurry lapping process to remove the surface damage left over from the wafer.

Chemical Mechanical Polishing (CMP)

The final polishing step is a combination of chemical etching and mechanical buffing.



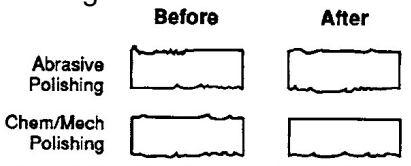


Figure 3.22 Abrasive and chemical-mechanical surface polishing.

Wafer Fabrication

Text book: Microchip Fabrication: A Practical Guide to Semiconductor Processing

By

Peter Van Zant

Capter-4: Wafer Preparation

Wafer Fabrication

Wafer fabrication is the manufacturing processes used to create the semiconductor devices in and on the wafer surface.

Wafer Terminology

1. Chip, die, device, circuit, microchip, or bar.
2. Scribe lines, saw lines, streets, & avenues.
3. Engineering die, test die.
4. Edge chips.
5. Wafer crystal planes.
6. Wafer flats/notches.

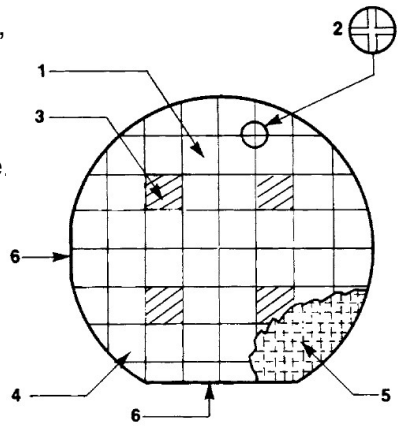


Figure 4.2 Wafer terminology.

Basic Wafer-Fabrication Operations

There are hundreds of thousands of different microchip types and functions. However, they are made with a small number of basic structures (primarily bipolar or MOS structures) and manufacturing processes.

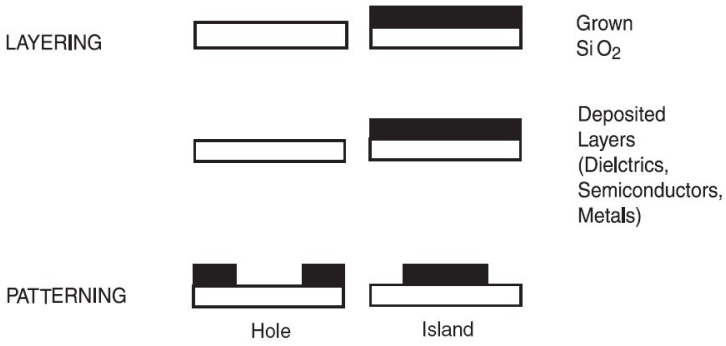
Basic steps of IC Fabrication

Followings are the basic steps used in an infinite number of sequences and variations to produce specific microchips.

- ***Layering,***
- ***Patterning,***
- ***Doping, and***
- ***Heat treatment***

Basic IC Fabrication Operations

Layering, Patterning, Doping & Heat treatment are the basic steps used in an infinite number of sequences and variations to produce specific microchips.



Basic IC Fabrication operations…