Tribology in Semiconductor

Tribology in Silicon Wafer Production

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What is Wafer?

- A thin slice of semiconductor material (silicon)
- Used in the fabrication of integrated circuits and other micro devices
Silicon Wafer Production Process
Crystal Shaping

(a) remove crown and taper,
(b) grind to required diameter
(c) grind flat
(d) slice sample for measurements.

*Shaded area represents material removed.
Slicing (Wire Saw)

- Tribology process that involves
  - wear (due to the abrasive SiC particles)
  - lubrication (by polyethylene glycol - PEG)
  - friction (caused by contact between the wire, the abrasive SiC particles and the Si ingot)
Edge Contouring

- performed in cassette-fed high speed equipment, in which each wafer is rotated rapidly against a shaped cutting tool.

Edge grinding

- An important step in the manufacturing of silicon wafer to reduce wafer breakage in the remaining manufacturing processes or future device manufacturing processes.
Lapping

- removes saw marks and defects from the surface of the wafers
- thins and relieves stress accumulated in the wafer from the slicing process
Polishing

- Polishing Pad - artificial fabric (polyester felt-polyurethane laminate)
- A mechano-chemical process
Difference between Polishing & Lapping

- Lapping only decreases the scale of the damage, but does not eliminate it entirely.
- Polishing is a mechano-chemical process during which brittle fracture does not occur.
Conclusion