

EE143 – Fall 2016 Microfabrication Technologies

Lecture 9: CMP

Prof. Ming C. Wu
wu@eecs.berkeley.edu
511 Sutardja Dai Hall (SDH)



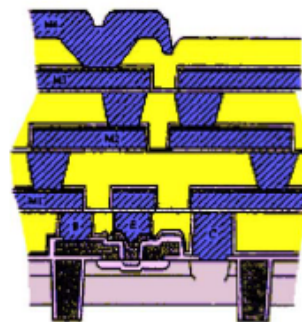
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Multilevel Interconnects



**Nonplanar
Metallization**



**Planar
Metallization**



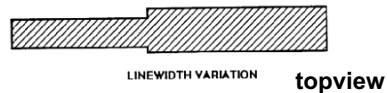
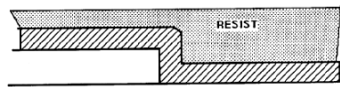
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Surface Planarization

- **Benefits for Lithography Processes:**

- Lower Depth-of-Focus requirement for lithography
- Reduced optical reflection effects on resist profiles
- Reduced resist thickness variation over steps



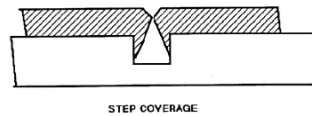
- **Benefit for Etching Processes:**

- Reduced over-etch time required due to steps



- **Benefit for Deposition Processes:**

- Improved step coverage for subsequent layer deposition

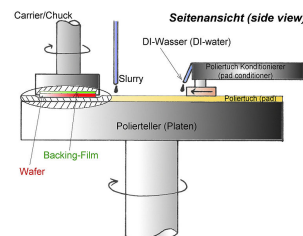
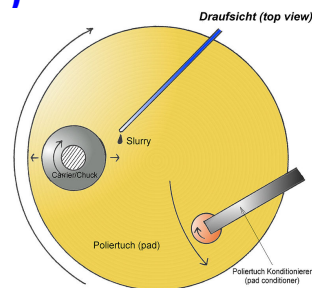


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Chemical Mechanical Planarization (CMP)

- Wafer is polished using a slurry containing
 - Silica abrasives (10-90 nm particle size)
 - Etching agents (e.g. dilute HF)
- Backing film provides elasticity between carrier and wafer
- Polishing pad made of polyurethane, with 1 mm perforations
 - Rough surface to hold slurry



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https://en.wikipedia.org/wiki/Chemical-mechanical_planarization



CMP Rate

Preston Model:

- Local Removal rate $R = K_p P v$
 - where
 - K_p = Preston coefficient [unit in pressure⁻¹]
 - P = local applied pressure
 - v = relative pad-wafer velocity
- K_p is a function of film hardness, Young's modulus, slurry, pad composition and structure

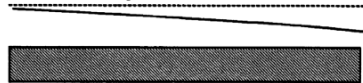


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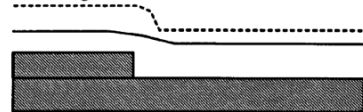


Problems Encountered in CMP

Non uniformity



Rounding



Dishing



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