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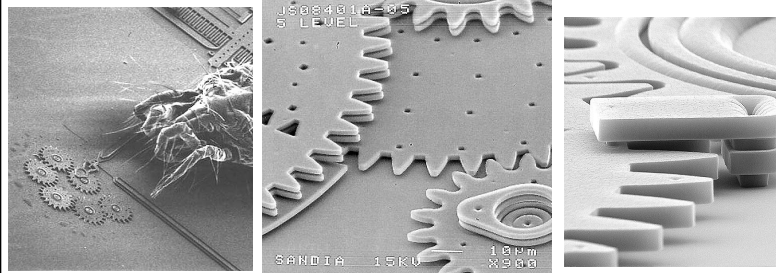
The Sandia SUMMIT Process

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Sandia's SUMMIT V

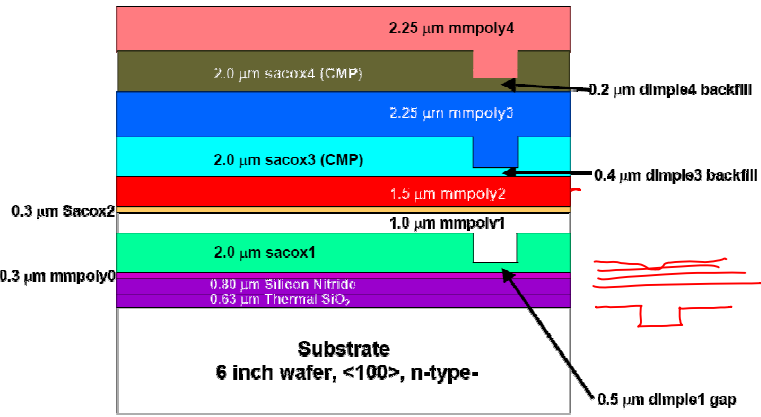
- **SUMMIT V: "Sandia Ultra-planar Multi-level MEMS Technology 5" fabrication process**
 - ↪ Five-layer polysilicon surface micromachining process
 - ↪ One electrical interconnect layer & 4 mechanical layers
 - ↪ Uses chemical mechanical polishing (CMP) to maintain planarity as more structural layers are realized
 - ↪ 14 masks



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SUMMIT V Layer Stack



Layer	Thickness	Material
mmpoly4	2.25 μm	Polysilicon
sacox4 (CMP)	2.0 μm	Silicon Dioxide
dimple4 backfill	0.2 μm	Backfill
mmpoly3	2.25 μm	Polysilicon
sacox3 (CMP)	2.0 μm	Silicon Dioxide
dimple3 backfill	0.4 μm	Backfill
sacox2	0.3 μm	Silicon Dioxide
mmpoly2	1.5 μm	Polysilicon
mmpoly1	1.0 μm	Polysilicon
sacox1	2.0 μm	Silicon Dioxide
mmpoly0	0.3 μm	Polysilicon
Silicon Nitride	0.80 μm	Silicon Nitride
Thermal SiO ₂	0.93 μm	Thermal Silicon Dioxide
Substrate	6 inch wafer, <100>, n-type-	Substrate

0.5 μm dimple1 gap

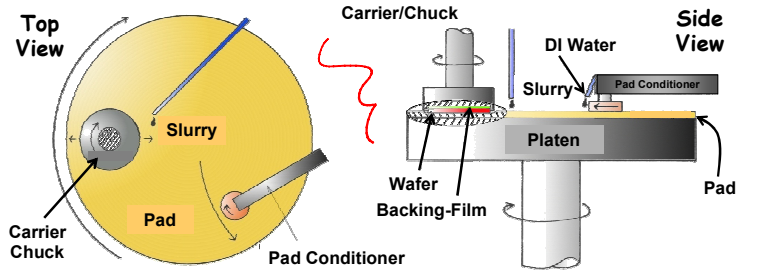
- Uses chemical mechanical polishing (CMP) to maintain planarity as more structural layers are realized

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Chemical Mechanical Polishing (CMP)

- Used to planarize the top surface of a semiconductor wafer or other substrate
- Uses an abrasive and corrosive chemical slurry (i.e., a colloid) in conjunction with a polishing pad
 - ↪ Wafer and pad are pressed together
 - ↪ Polishing head is rotated with different axes of rotation (i.e., non-concentric) to randomize the polishing



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CMP: Not the Same as Lapping

Lapping

- Lapping is merely the removal of material to flatten a surface without selectivity
- Everything is removed at approximately the same rate

Lapping

Chemical Mechanical Polishing

- CMP is selective to certain films, and not selective to others

Stops at non-selective layer

CMP

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Actual SUMMiT Cross-Section

- No CMP until after the first three polySi layers
- 1 μm mmpoly1 and 1.5 μm mmpoly2 can be combined to form a 2.5 μm polysilicon film
- Refer to the SUMMiT V manual (one of your handouts) for more detailed information on masks and layout instructions

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