Interface Mechanisms of Chemical Mechanical Polishing

Precision Machining Research Consortium
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Commercial I.C. - CMP

*Interface Mechanisms Poorly Understood
*Limited Mfg. Predictability (Guess-Work)
Expected Mechanism

(Hydrodynamic Polishing)
**Apparatus**

- Wafer Sample Beneath Mount
- Overhead Structure
- Pad Mounted on Turntable
- Linear Bearing
- Loading Shaft
- Spherical Joint
- Capacitance Displacement Probe
- D.A.S.
Experimental Result

Normal Load

\[ V = 0 \]

Differential Wafer Displacement

\[ -\delta \]

Suction Force

Normal Load

\[ V > 0 \]

Hydrodynamic CMP Ineffective
Results - Wafer Displacement

- Initial Pad Static Compression
- Vertical Differential Wafer Displacement
- Final Pad Static Compression After Completion of Dynamic Test
Suction Force Mechanism

- Normal Load
- Pad Asperities
- Contact Stress
- Asperity Rebound
- Slurry Pressure, KPa
- Wafer Position, mm
Suction Force Model
Application

Former Model
Polishing $\propto$ Normal Load
Polishing Rate $\propto$ Normal Load

New Model
Polishing $\propto$ Normal Load $+$ Suction Force
Polishing Rate $\propto$ Normal Load $+$ Suction Force

Normal Load

Suction Force