

Effect of Pad Conditioning Methods on Wafer-Slurry-Pad Coefficient of Friction

Lateef Mustapha, Leslie Charns & Ara Philipossian

University of Arizona

Department of Chemical & Environmental Engineering

Tucson, AZ USA

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Driving Force

Characterization, fundamental understanding and control
of the magnitude of shear forces
in the pad-slurry-wafer region
is an integral element in developing optimal planarization processes
for low k dielectric applications

Adoption of improved pad conditioning schemes
will be required to impart desired shear forces on the wafer during
CMP

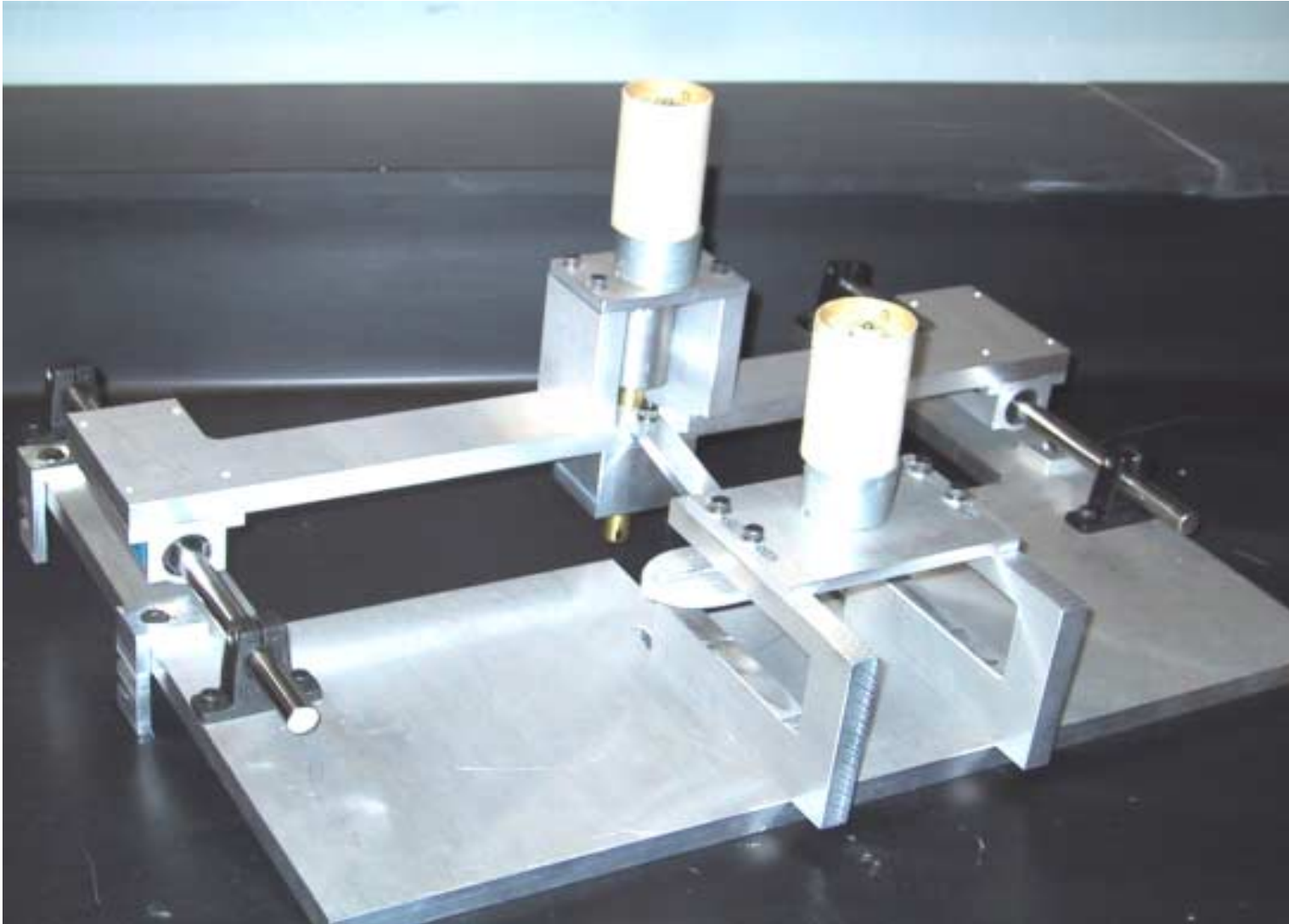


Outline

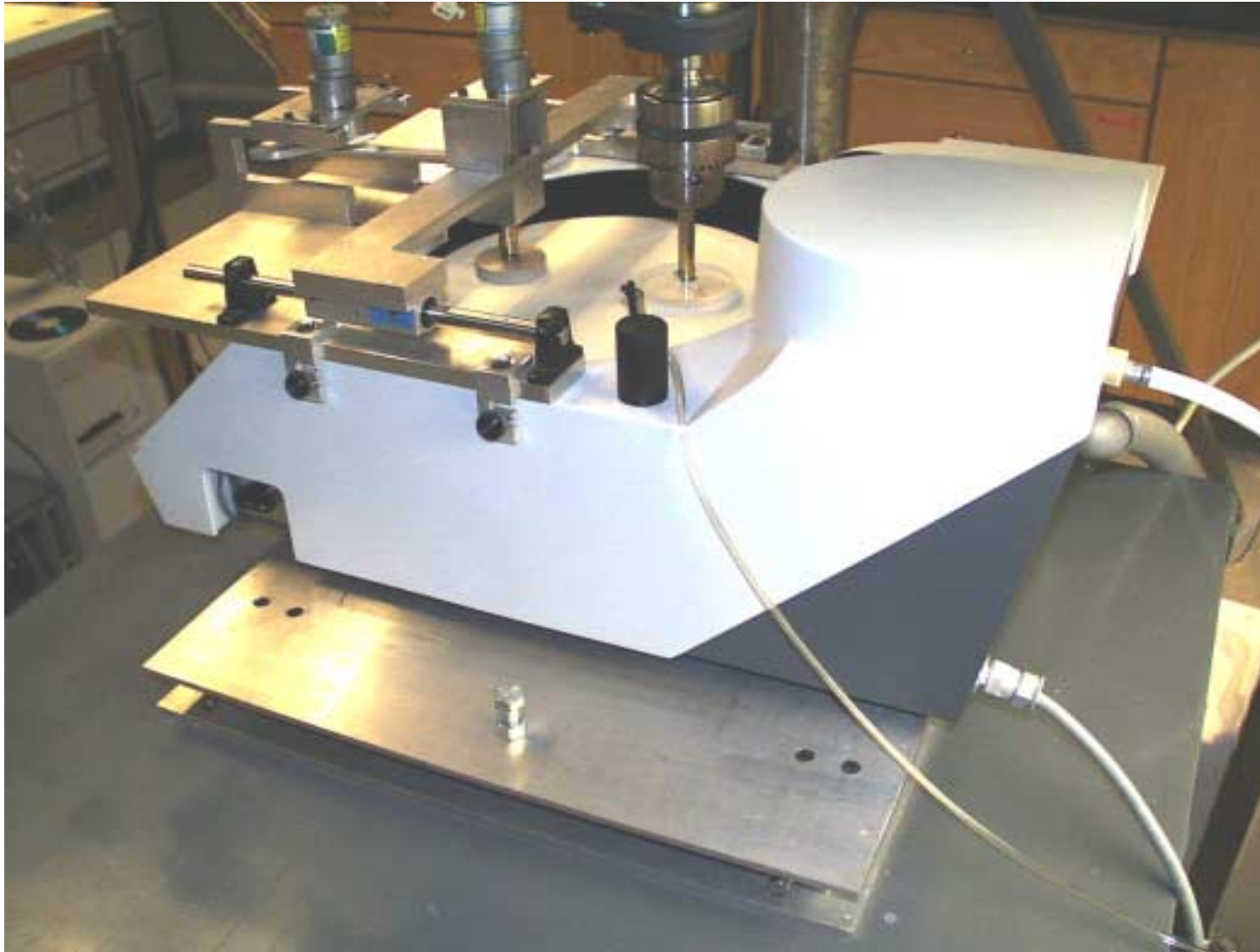
- Experimental apparatus
- Experimental procedure
 - Slurry
 - Process conditions
 - Initial pad conditioning and break-in
 - In-situ pad conditioning methods
- Results & Discussion
- Future plans



Conditioning Arm



CMP Apparatus with Integrated Conditioning Arm



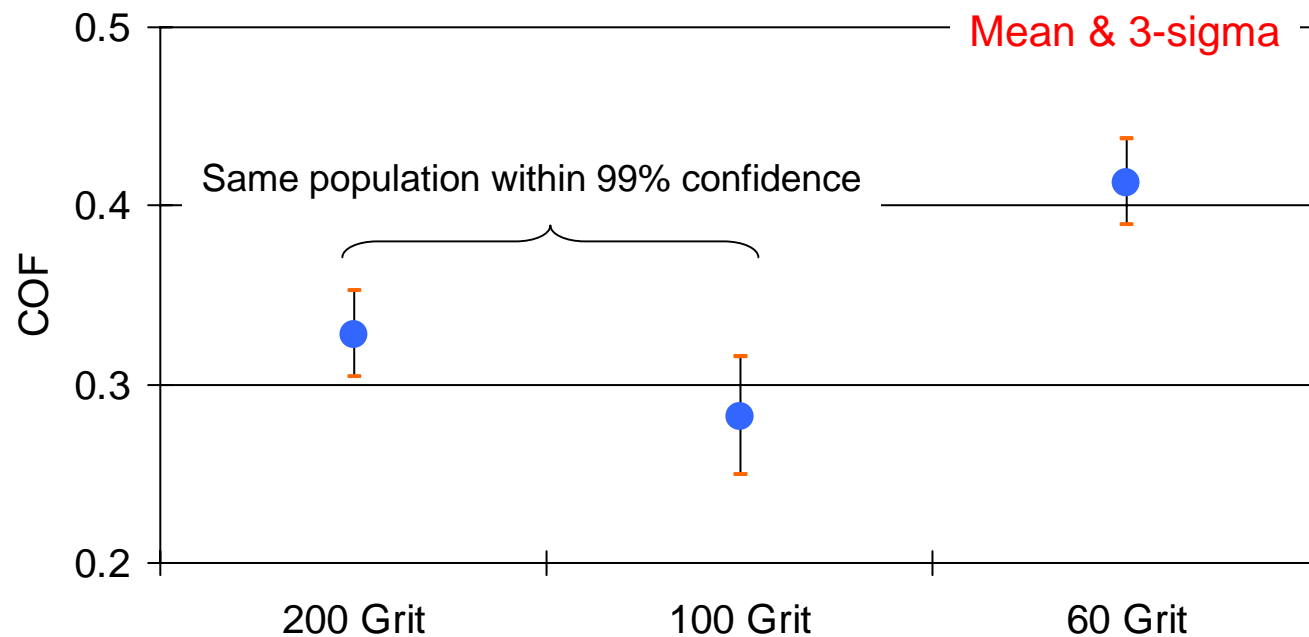
Experimental Procedure

- Pad ... Rodel IC-1000 perforated (no sub-pad)
- Initial pad conditioning and break-in:
 - 30 minute initial conditioning followed by 1 minute break-in with dummy wafer
 - Diamond disk ... 100 grit
 - Disk speed ... 30 rpm
 - Sweep frequency 30 times per minute
- Polisher conditions:
 - Platen speed ... 80 rpm (matched to wafer speed)
 - Wafer pressure ... 3 psi
 - Slurry flow rate ... 35 cc per minute
- Slurry ... Fujimi PL-4217 (fumed silica) at 12.5% solids
- In-situ conditioning parameters (orthogonal matrix):
 - Diamond disk ... 60, 100 & 200 grit
 - Disk speed ... 30, 50 & 70 rpm
 - Disk sweep frequency ... 10, 20 and 30 per minute



Results

- No relationship was found between disk sweep frequency and COF
- No relationship was found between disk rotational speed and COF
- Diamond grit size seems to be a critical parameter and warrants further study



Future Plans

- Verify that sweep frequency and disk rotational speed do not affect COF
- Verify the effect of diamond size on COF
- Obtain SEM micrographs of pads and diamonds before and after conditioning in order to explain the above results
- Study effect of pad conditioning on COF as a function of:
 - Various pads
 - Various diamond disks
 - Conditioner down pressure
- Determine if there is a correlation between COF and:
 - Pad life
 - Diamond life
- Develop comprehensive model which describes the above observations

