Effect of Various Pad Conditioning Parameters on Coefficient of Friction and Removal Rate for ILD CMP Applications

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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 ILD (and especially low k ILD) applications. As a result, adoption of improved pad break-in and conditioning schemes will be required to impart desired shear forces on the wafer during CMP.

In this study, various conditioning parameters are explored. These include:

- The kinematics of the conditioner such as sweep rate and disk rotational speed
- Pressure applied by the diamond disk on the pad
- Diamond grit size
- Conditioning time
- In-situ or ex-situ conditioning

The effect of the above factors on COF during ILD polish as well as ILD removal rate is explored. Additionally the effect of conditioning parameters on the tribological mechanism is demonstrated.

The top figure shows the conditioning assembly connected to the table top polisher and to the friction table for real-time COF analysis.

Preliminary results showing the effect of diamond grit size on COF is shown in the bottom figure indicating that the coarser the diamond (i.e. 60 grit), the higher the coefficient of friction.

SEM and stylus profilometry are used to determine the surfaces of the diamond disks and the pads before and after polish. This data is the used to explain the observed trends in removal rate, COF and the overall tribology of the system.