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REPORT ON CLOSING METROLOGIES GAPS FOR WAFTER MEASUREMENTS AT DIFFERENT STAGES OF CMP PROCESS

Report on Closing Metrologies Gaps for Wafer Measurements at Different Stages of CMP Process

Chemical Mechanical Planarization Consumables (CMP-C) Task Force

Liquid Chemicals North America Technical Committee

STANDARDS

CONNECT - COLLABORATE. - INNOVATE. - GROW. - PROSPER

Members of the CMP-C Task Force

- Alex Tregub, ATCP Consulting, a.tregub@yahoo.com
- Amanda David, Intel, amanda.david@intel.com
- Laura Ledenbach, Evonik, laura.ledenbach@evonik.com
- Don Hadder, Intel, don.e.hadder.jr@intel.com
- Wei Fan, Entegris, wei.fan@entegris.com
- Garry Xing, ICHOR Systems, gxing@ichorsystems.com
- Darren Conner, Evantic, darren.conner@evantic.com
- Juan Atkinson Mora, Zeiss, juan.atkinsonmora@zeiss.com
- Paul Kerr, Intel, paul.d.kerr@intel.com
- Norman Meznarich, Intel norman.a.meznarich@intel.com
- Paul Lefevre, Entegris, paul.lefevre@entegris.com
- Michael White, Entegris, michael.white@entegris.com
- Andrea Tiwari, TSI, andrea.tiwari@tsi.com
- Bradley Wood, Entegris, bradley.wood@entegris.com
- David Kandiyeli, Kinetics Equipment Solutions Group, david.kandiyeli@kinetics.net
- Jenna Miles, Avery Dennison, jenna.miles@averydennison.com
- Serena Stephenson, DuPont, serena.k.stephenson@dupont.com
- Charles, Hamilton, Entegris, charles.hamilton@entegris.com
- Derek Oberreit, Kanomax FMT, derek.oberreit@kanomaxfmt.com

Goal

- Identify existing metrology gaps in measuring and reporting properties of the wafers at different stages of CMP processes.
- Guide suppliers of CMP chemicals and consumables, vendors of the analytical tools and IDMs/ODMs to close existing metrology gaps.

Acronyms

- AFM Atomic Force Microscopy
- EDX Energy Dispersive X-ray Spectroscopy
- IDM Integrated Device Manufacturer
- LSDIS Laser Scanning Defect Inspection System
- ODM Original Device or Design Manufacturer
- OI Optical Interferometry
- OM Optical Microscopy
- RR Removal Rate
- SEM Scanning Electron Microscopy
- SR Surface Roughness
- TEM Transmission Electron Microscopy
- TXRF Total Reflection X-ray Fluorescence

Metrologies for CMP Wafers

Material	KPI(s)	Property Measured	Existing Metrology	CMP Process In Line/ Off Line	Gap/ No Gap	Comment
Metal Blanket Wafer	Thickness Uniformity RR	Thickness using Impedance	4-point probe	In Line	Gap	Test is destructive. Test is for metal layers only. Not available for patterned wafers. Limited range of thicknesses that can be measured. Wafer edge measurements is a challenge.
Metal & Oxide Blanket Wafer	Thickness Uniformity RR	Thickness using optical parameters	OI	In Line	Gap	Lack of straightforward models for multicomponent discrimination. In-situ real time measurements is an opportunity. Wafer edge measurements is a challenge.
Metal & Oxide Patterned Wafer	Local topo Uniformity Planarity Dishing Erosion RR	Thickness Step Heughs	OI	In Line	Gap	Lack of straightforward models for multicomponent discrimination. X-Y Spatial resolution Additional step of deposition may be required. Need to cross section to validate or calibrate model accuracy.

Metrologies for CMP Wafers

Material	KPI(s)	Property Measured	Existing Metrology	CMP Process In Line/ Off Line	Gap/ No Gap	Comment
Metal & Oxide Patterned Wafer	Local topo Uniformity Planarity Dishing Erosion RR	Thickness, Step Heughs, SR	AFM	In Line	Gap	Limited area of scanning. Need to decorate wafers with coating.
Metal & Oxide, Blanket & Patterned Wafers	Defectivity	Electrical signals	In Line E-tests	In Line	No Gap	Measured before dicing into the chips. Not always correlated to EOL tests. Nature of the defects not always reported. Suppliers 'metrologies are focused on blanket wafers- need measurements on patterned wafers
Metal & Oxide, Blanket & Patterned Wafers	Defectivity	Defect count, defect shape, defect composition	EDX-SEM, OI, OM, E-beam, LSDIS	In Line	Gap	Inspection speed: OI, SEM, OM, E-beam. EDX , SEM can be distractive
Metal & Oxide, Blanket & Patterned Wafers	Defectivity	Defect count, defect shape, defect composition	TXRF, ToF-SIMS, TEM	Off Line	Gap	All destructive; Non automated; slow-requires a lot of preparation