

Copper Plating

*Copper structures on
300 mm wafer*

The ECD process

In an integrated circuit interconnects are the dominant factor in determining system performance. The usage of copper for wiring and electrochemical copper deposition (ECD) are the state of the art in ULSI production these days. At Fraunhofer IPMS the ECD process and the copper material are being constantly optimized to guarantee high performance and low power signaling together with long durability.

We investigate and optimize the ECD process for the galvanic deposition of metal layers through electrolyte screening, bath life time investigation and process characterization. Electrochemical measurement methods (cyclic voltammetric stripping, electrochemical impedance spectroscopy) and extensive analytics are available at Fraunhofer IPMS to study copper superfillings.

Advantages

- Evaluation of new equipment and materials under industry standard conditions
- Leading edge plating tools for process optimization:
 - AMAT Raider Edge ECD
 - LAM Sabre Extreme
- Pre- and post-processing for optimization of individual process steps
- Inline metrology
- Professional contamination management
- Professional IP management and licensing
- Close connection to industry

Applications

- 28 nm technology node & below
- 300 mm wafer & beaker tests
- Dual damascene plating
- Bump plating
- TSV plating

interconnects

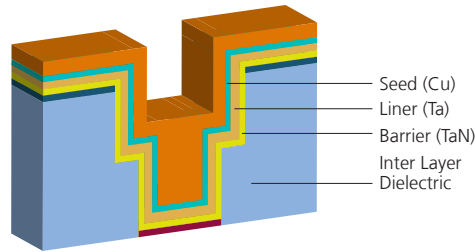
high-k devices
non-volatile memories
nanopatterning

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▲ Cross-section of a dual damascene interconnect structure.

◀ Concentration series of copper electrolyte for the investigation of structure filling behavior.

Plating tool AMAT Semitool Raider ECD in 300 mm cleanroom at Fraunhofer IPMS. ▶



Customer services



MATERIAL SUPPLIERS

- Chemical screening
- Performance / endurance tests
- Supply of industrial test vehicles
- Lab-to-Fab services:
 - Scaling products from lab to industry grade
 - ECD additive evaluation and process scale-up
 - Process parameter definition for industrial ECD
 - Process integration and test



IC MANUFACTURERS

- Recipe development and management
 - Product Benchmarking
- Internal and external testvehicle
- Defect inspection/characterization
 - Process performance evaluation
- Pre- and post processing
 - Unit Process development and process integration
- Characterization:
 - Laboratory (destructive / non-destructive)
 - Inline

Analytics

- Surfscan wafer analysis
 - KLA Tencor SP2 & SP3
- 4-point resistivity measurement
 - KLA Tencor RS100
- Topography measurement
 - KLA Tencor HRP340 & NanoFocus CFM, WLI
- Ellipsometry & Bow/Stress test
 - KLA Tencor FX100
- Review SEM
 - Applied Materials G3 FIB
- Patterned defect inspection
 - NextIn Aegis I
- FIB-SEM, TEM, EBSD
 - FEI Strata400/FEI F20 (200 kV)
- ToF SIMS
 - Ion ToF 300R
- Plating Bath Analysis (organics & inorganics)
 - ECI Elite V20
- Potentiostat/Galvanostat
 - Princeton Applied Research

300 mm research & development platform

Fraunhofer IPMS is an established test platform for microelectronics and nanotechnology operating on standard industry equipment for 300 and 200 mm wafer size. We offer independent evaluations for suppliers, material developers and equipment manufacturers with direct exchange of wafers (short loops), connection to industrial media supply and professional contamination management. Fraunhofer IPMS is certified under the ISO 9001 quality management system.

The Fraunhofer-Gesellschaft is the leading organization for applied research in Europe. Its research activities are conducted by 76 institutes and research units located throughout Germany. The Fraunhofer-Gesellschaft employs a staff of about 30,000 people, with an annual research budget totaling more than 2.8 billion euros.

