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ElectroChemical Pattern Replication

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FlipChips Dot Com

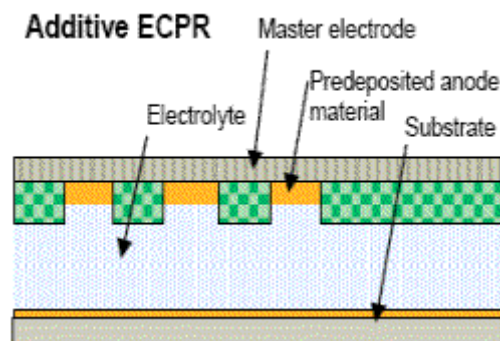
ElectroChemical Pattern Replication (ECPR) is an advanced technology for creating highly accurate micro/nanoscale metal patterns for microelectronics, with major cost and performance advantages over present approaches. The proprietary technology is currently being commercialized by Replisaurus Technologies for introduction during 2009.

PROCESS

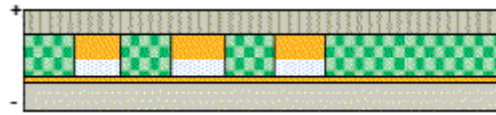
A patterned template is the master electrode for replication. It includes one or more patterned insulating layers on the conductive electrode layer. The template is pressed against a wafer or substrate that is covered with electrolyte, squeezing out excess electrolyte to create electrochemical microcells conforming to the pattern.

Applying an appropriate electrical potential between the master electrode and substrate surfaces will electrochemically etch or plate the pattern on the substrate. For plating, the pattern cavities are pre-filled with the desired metal.

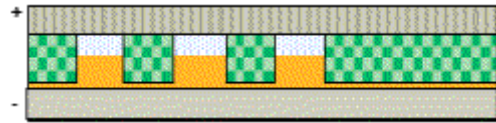
Figure 1 illustrates the sequence for an additive plating deposition:



In Figure 1a, the master electrode with the desired pattern defined in an insulating layer (checkered area) is aligned with the substrate. The substrate, which may be a semiconductor wafer, has a conductive metal seed layer on its surface and is flooded with a liquid electrolyte. The anode material to be transferred was pre-deposited in the electrode cavities.



In Figure 1b the master electrode pattern has been pressed against the substrate, displacing excess electrolyte and creating individual local plating cells in the cavities of the pattern.



. In Figure 1c, an electrical potential applied between the master electrode and the substrate transfers material in each isolated cell from the anode to the substrate.



. In Figure 1d, the transferred material has replicated the original pattern on the substrate. The master electrode is separated from the substrate, and the exposed portions of the seed layer are removed from the substrate.

RESULTS

With uniform contact over the whole surface of the substrate, high resolution patterns can be closely replicated. Replication of 500 nanometer line widths with 250 nanometer spaces has been demonstrated.

The unobstructed perpendicular electric field in each cell produces uniform current densities over the entire substrate, for excellent deposit thickness control and uniformity.

Electrode spacing of less than 10 microns limits electrolyte diffusion regions, allowing plating rates in excess of 5 microns per minute without dendrite formation.

ADVANTAGES

Compared to conventional photolithography-based electroplating:

- Eight process steps are reduced to three.
- Six pieces of equipment are replaced by one.
- A one-hour plating process is reduced to five minutes.
- Superior line width, spacing and uniformity.
- Fab-friendly, environmentally clean process, with no solvents, developers, or strippers.

Lower costs will result from increased throughput, higher yield, lower equipment acquisition costs and less clean-room space. Fewer tools require fewer operators and reduce maintenance costs. Consumable costs and chemical handling costs are also reduced.

APPLICATIONS

Priority applications include wafer redistribution, integrated passive devices, fine-pitch pillar bumping, and power IC metallization. Optoelectronics, MEMS, sensors, flat panel displays, and advanced circuit boards may also benefit from this approach.

STATUS

Replisaurus is currently commercializing the process.

In June, Replisaurus purchased Smart Equipment Technology (S.E.T), the former Bonder Division of SUSS MicroTec, a leader in high accuracy bonders and nano-imprint steppers. This division produced the machine that Replisaurus adapted to ECPR development.

ECPR is in the first demonstration stage, and plans to engage customers in extended demonstrations by 2009, with first tools in the market by 2010.

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