Content

- 3D-TSV/TSV Process Overview
- Advantages of using dry film photoresist
- Dry film photoresist for 3D-TSV Process
- Summary
Our Mission

To enhance customers’ competitiveness and profitability by offering

Application knowledge

Materials

Integrated Process Technology
DuPont Lithography Material Features

High Aspect Ratio Imaging

- Thick polymer films (50-120um) for thick plating and stencil applications
- Strong heat resistance
- Clean removal

Fine Feature Imaging

- Thin polymer films (10-30um) for high definition plating and etching applications

High Definition Permanent Dielectrics

- Polymer films for permanent structuring and dielectric applications
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3D-TSV/TSV Process Overview

Via First

Via Last Front Via

Via Last Back Via

Si Wafers

FEOL

BEOL

Final Assy.
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Dry Film process

Wafer

Polyester Film
Photopolymer Film
Polyethylene Film
DuPont MPF™
Microlithographic Polymer Films

Spin on Liquid
5.5 mm less usable area due to edge bead

No Edge Bead
Maximized usable area
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Integrated Solution on 3D-TSV device

**WOW-TSV Memory / Logic SiP module**

- Micro-bump
- Via creation
- Via protection
- Via plating

**Materials and Processes**

- Zyron® Depo. Cleaning gas
- Dry etching gas
- Vertrel® CF deposition
- Cleaning agents
- XP-3000/XP-7000 series
- Wafer level Polyimide
- Underfill
- Syton® Mazin®
- BG polish
- Wafer polish
- EKC series
- PCMP cleaner
- Dryfilm/Thick PR Remover & Chemicals
- HD series
- Photo sensitive
  Polyimide coatings
- APL /WB/ MX series
- Dry Film photoresist
- CooLam™
  Thermo conductive/
  Thermal resistant
  Substrate system
Via Creation
DuPont® Ultrathin Dry Film for small via (7-10 um)

7 μm φ

10 μm φ

12 μm φ

x1000

x1500
MX5000 series

Via Creation

◆ One step application process
◆ High selectivity to DRIE process (>100:1)
◆ High temperature resistance (>200°C)
◆ Thickness uniformity (± 2%)
An example of Via creation process scheme

- MX5000 series Dry Film Photoresist
- Zyron® high purity fluorine containing gases

- EKC WLP series ® Dry Film Remover

- Vertrel® XF (C5H2F10) CF deposition remover
- EKC265, EKC2255 residue remover
Via Protection & Via Plating
Process limitation of liquid photoresist

Via Tenting - No PR in the via

Lamination

Coating bubbles in via

Spin Coat

Silicon Via/Trench

Negative

Mild chemical for Development
- 1% Na2CO3/K2CO3

Harsh chemical for Development
- TMAH: copper etch
- KOH: Al etch

Development residue in via
MX5000 series
Via Plating

DuPont® MX5000 Dry Film Photoresist

- One step, simple application process
- “Tenting” over vias
- No Residue inside the vias

Dry film “tenting” over existing vias
Residue free via ready for plating

After Lamination
After Development
An example of the MX5000 series.
Via Protection

DuPont® MX5000 Dry Film Photoresist

- One step, simple application process
- “Tenting” over vias
- No Residue inside the vias

Dog Bone Structure after development

Dog Bone Structure after metal etch

Protected un filled via after removal

Protected filled via after removal
Micro Bump & Cu Pillar
An example of Bump process scheme

- WBR2050 series Dryfilm Plating mask

- EKC WLP series ® Dry Film Remover

- HD4100/HD8820 series PI coatings
DuPont® WBR2050 series

Photoresist: MPF™ WBR50

Surface: Cu

Exposure: Suss MA200

Plating Electrolytes: Nexx Plating Tool (Vertical Plating) RH 8540

Remover DuPont EKC WLP™

Courtesy of Nexx Systems
Summary
Superior properties of dry film photoresist

1. Photoresist Lamination / Exposure / Development
   - Fast throughput
   - Excellent dimension control
   - Good resolution
   - Wider operation window
   - Mild chemical compatible process (Metal corrosion-free Chemicals)

2. Via Etching
   - High selectivity in via etching process
   - No Cracking or Pull-back during etching process
   - Residue-free after via etching process

3. Plating & Tenting (Via Filling and Micro Connection Metal Deposition)
   - Good Plating capability
   - Residue-free development

4. Stripping
   - Excellent Stripping capability

One DuPont Solution for TSV!