Unique Dry Film Photoresist System for TSV Via Formation/Protection/Plating

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DuPont APL ATG Specialist

March 19, 2008

Solutions for Innovation

DUPONT®

The miracles of science™

Content

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

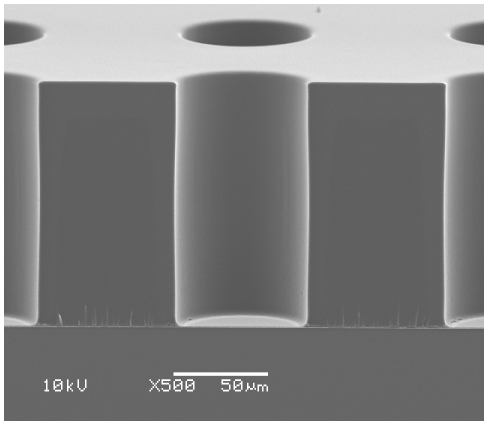
Our Mission

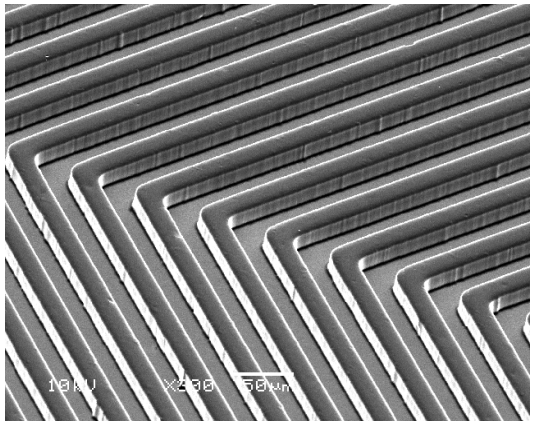
To enhance customers' competitiveness and profitability by offering

Application knowledge

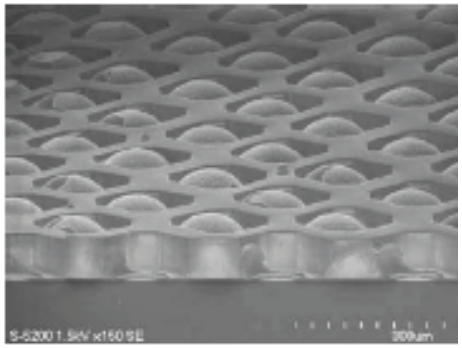
Materials

Integrated Process Technology



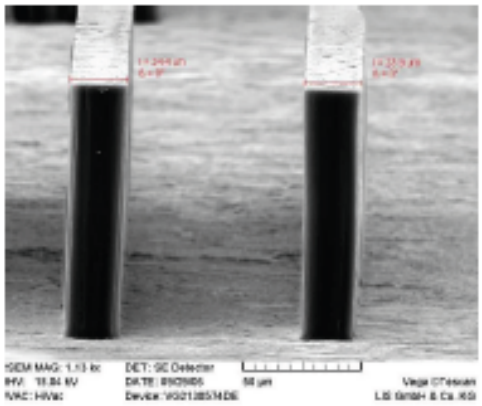


DuPont Lithography Material Features



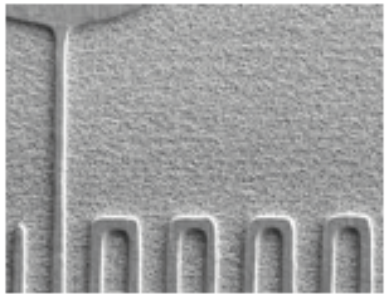
High Aspect Ratio Imaging

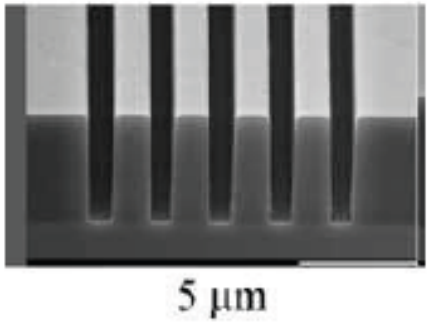
- Thick polymer films (50-120um) for thick plating and stencil applications
- Strong heat resistance
- Clean removal



Fine Feature Imaging

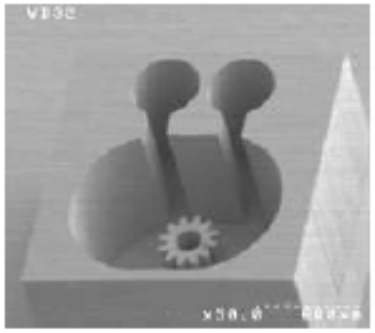
- Thin polymer films (10-30um) for high definition plating and etching applications





High Definition Permanent Dielectrics

- Polymer films for permanent structuring and dielectric applications



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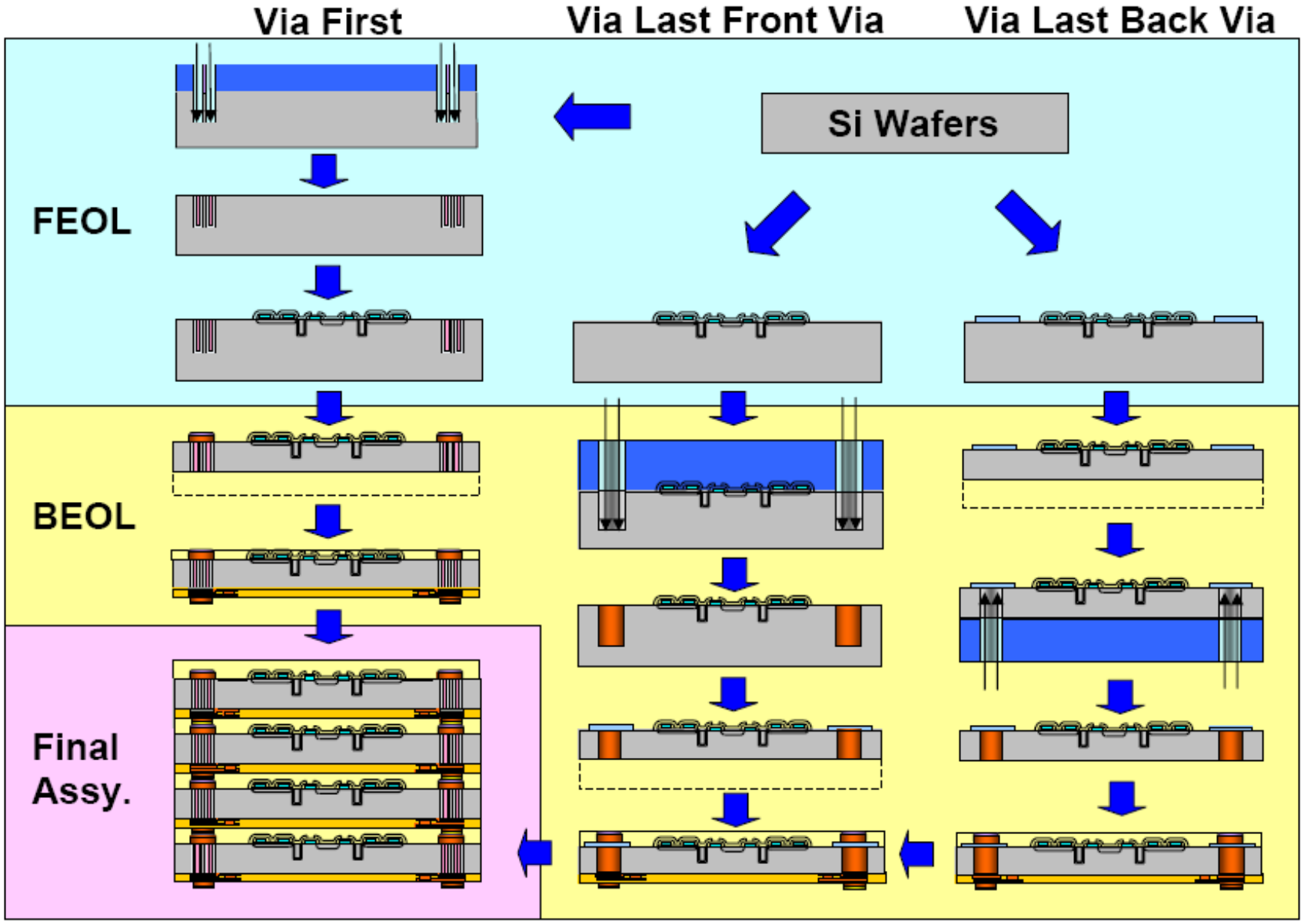
- **Advantages of using dry film photoresist**
- **Dry film photoresist for 3D-TSV Process**
- **Summary**

3D-TSV/TSV Process Overview



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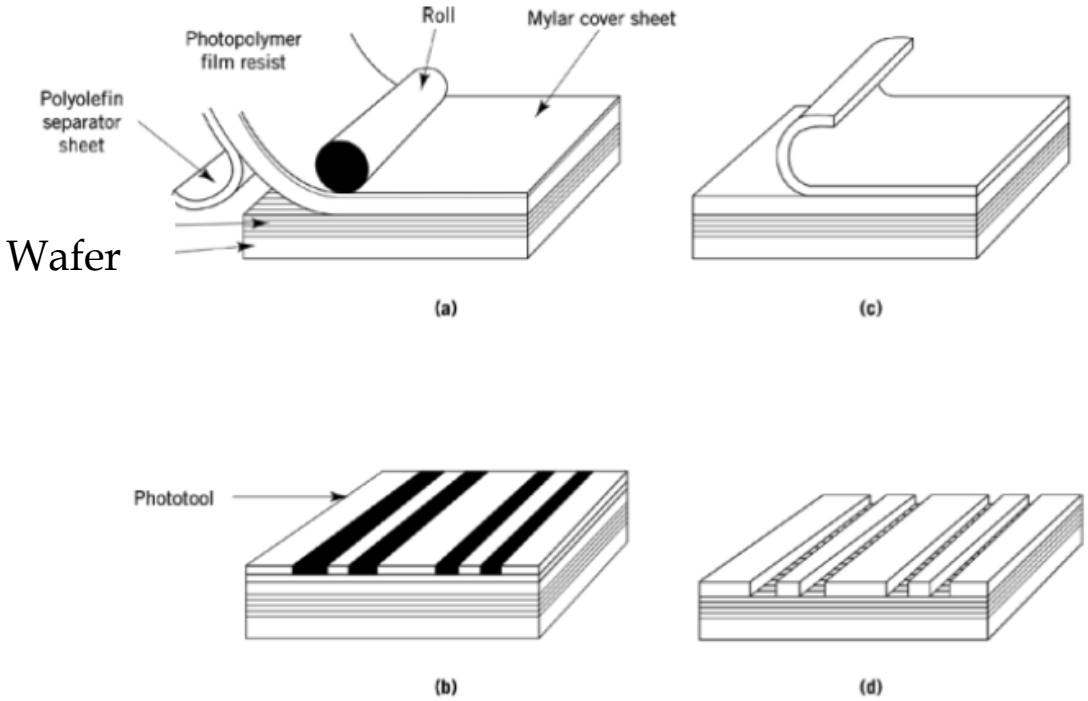
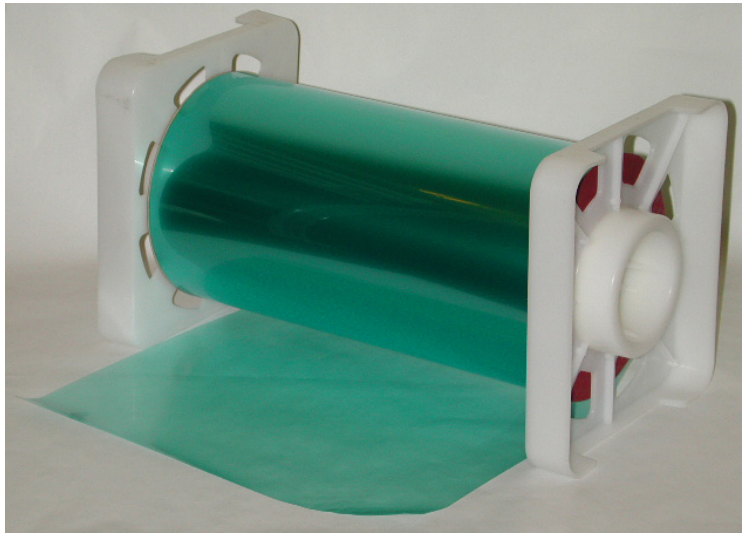
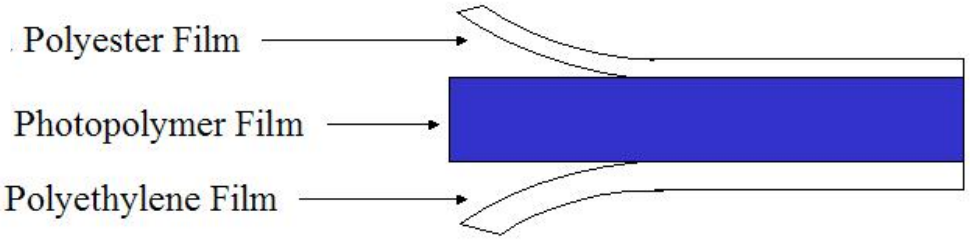
Dry Film process

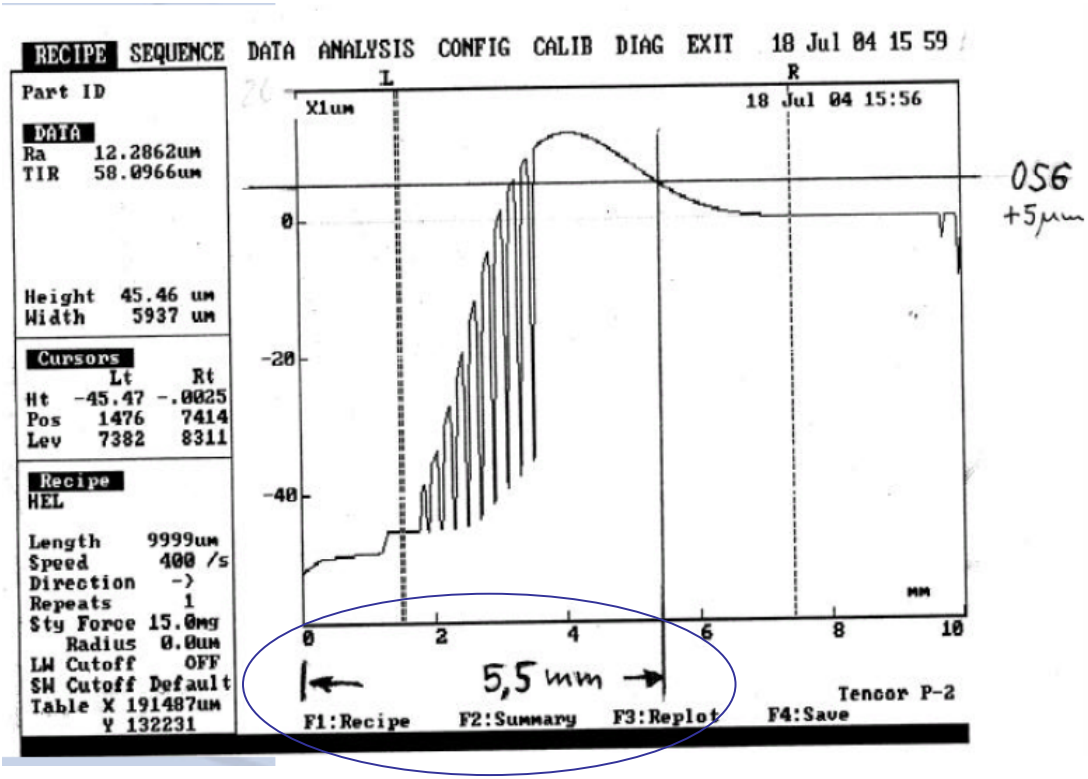






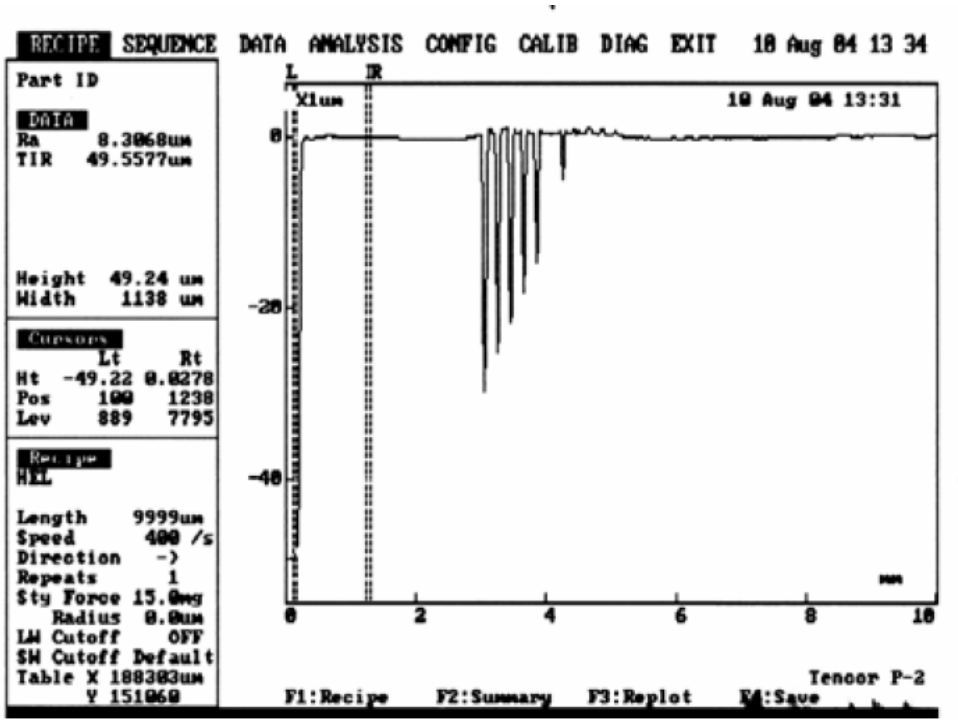
DuPont MPF™
Microlithographic Polymer Films

No Edge Bead



Spin on Liquid

5.5 mm less usable area due to edge bead



MPF™

Microlithographic Polymer Film

Maximized usable area

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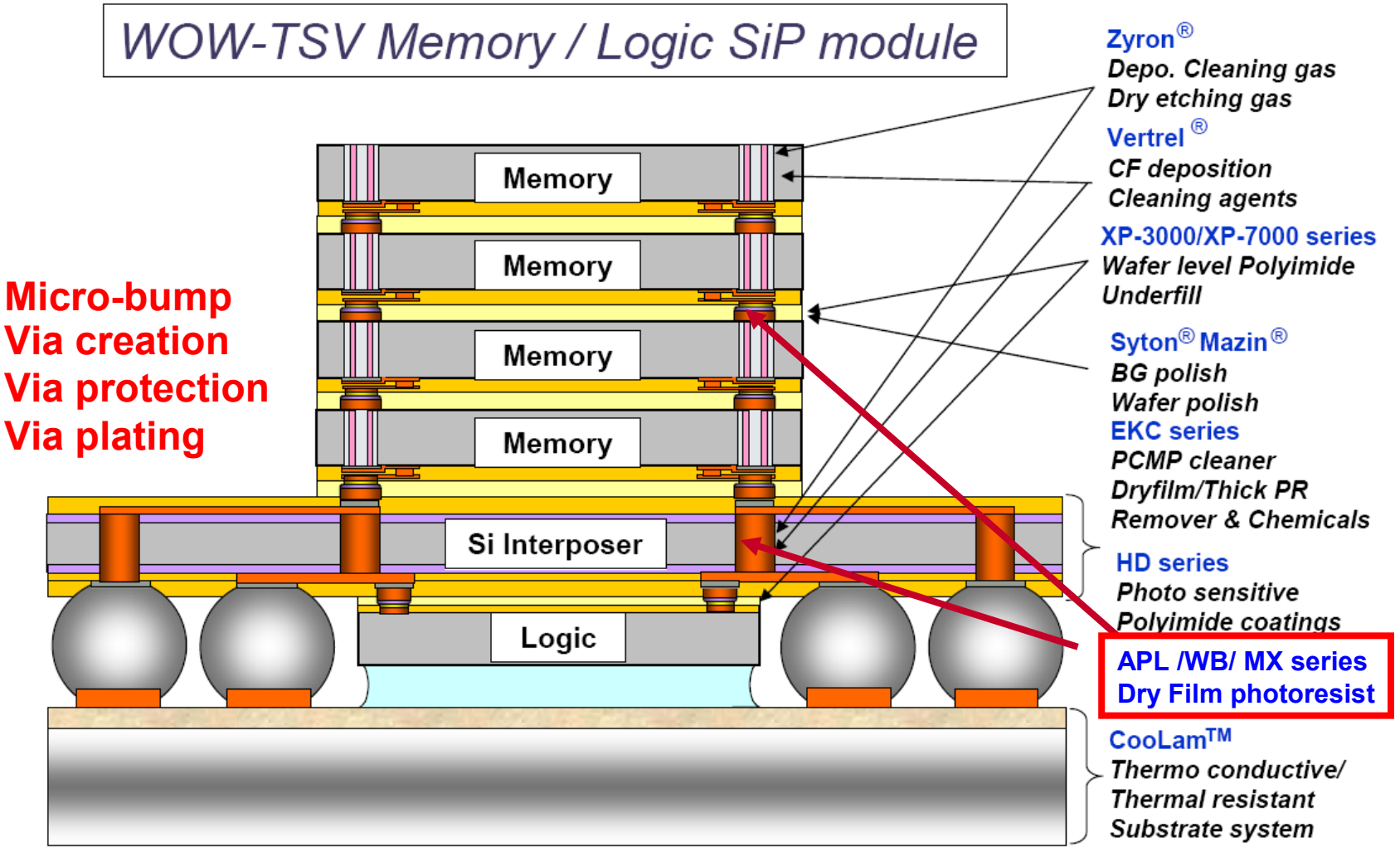
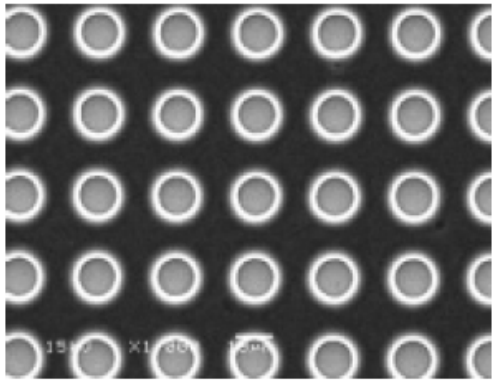
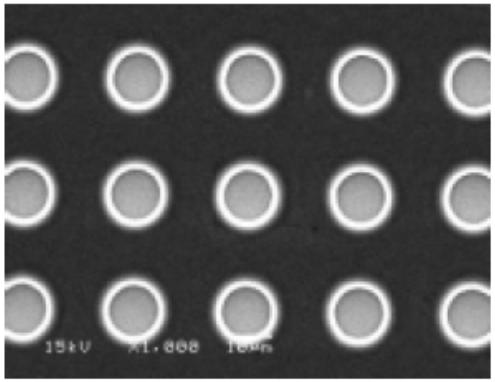
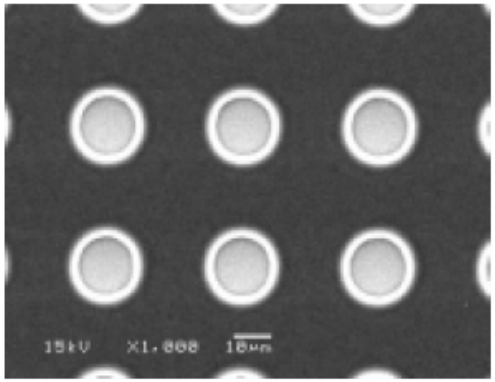
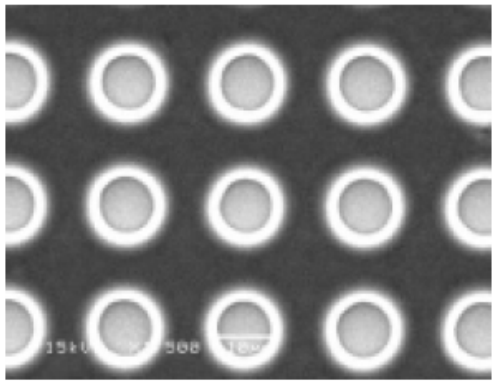
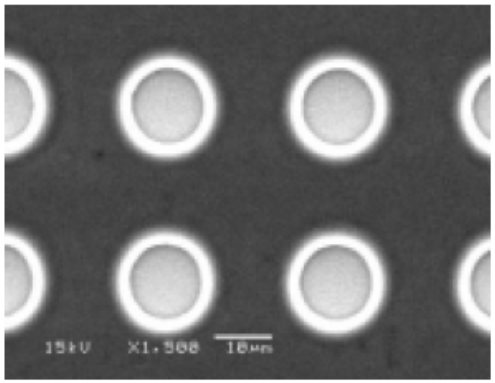
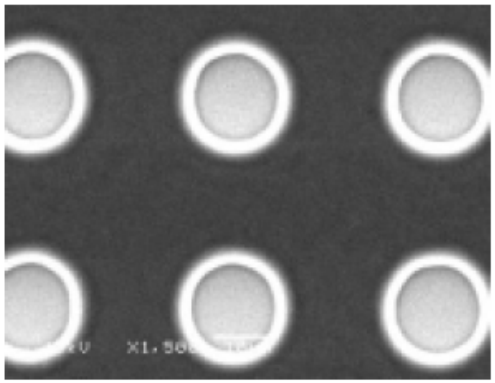
Integrated Solution on 3D-TSV device



Via Creation

DuPont® Ultrathin Dry Film for small via (7-10 um)

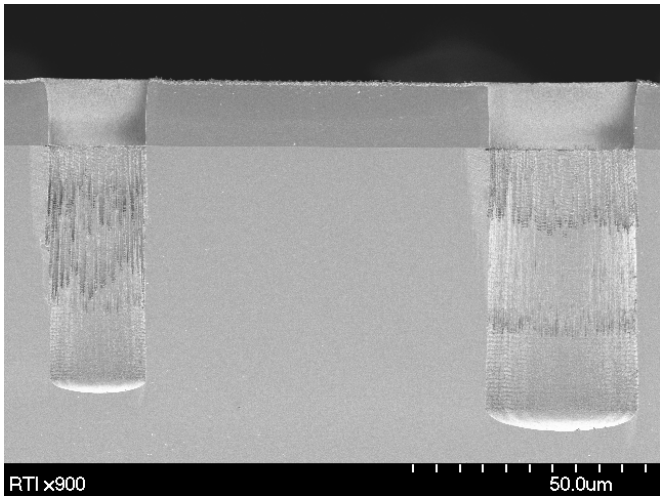
	7 μ m ϕ	10 μ m ϕ	12 μ m ϕ
x1000			
x1500			

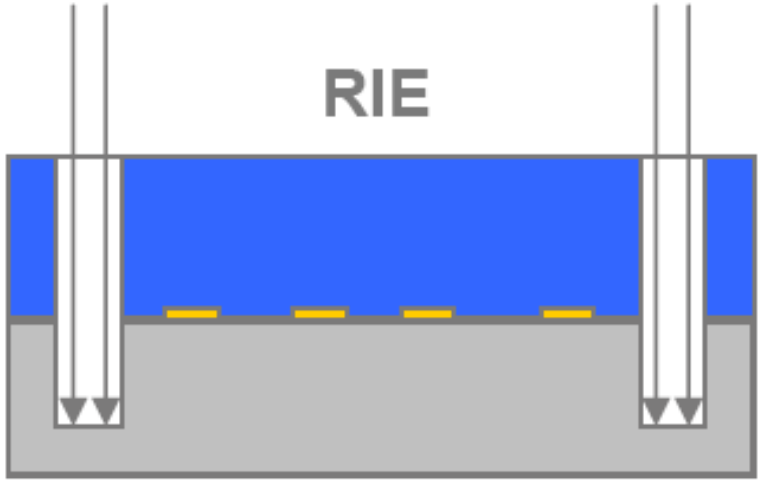
MX5000 series

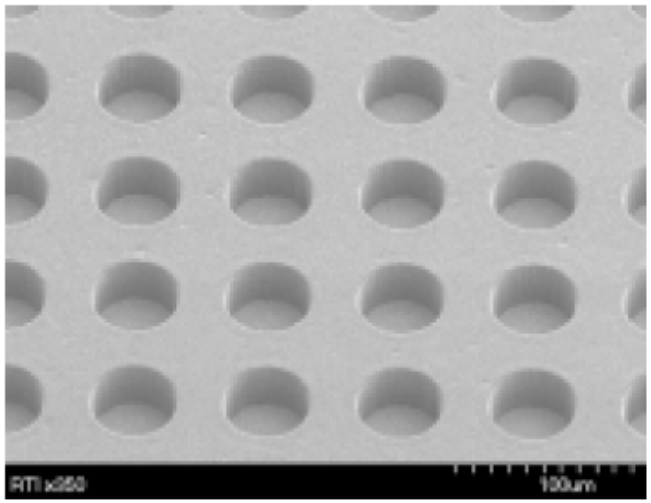
Via Creation

DuPont® MX5000 Dry Film Photoresist

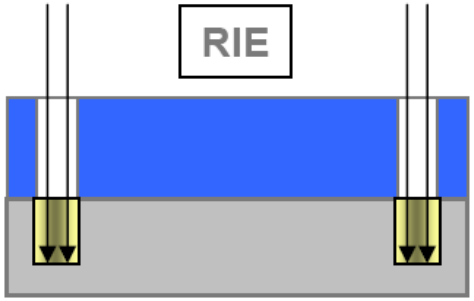
- One step application process
- High selectivity to DRIE process (>100:1)
- High temperature resistance (>200C)
- Thickness uniformity (± 2%)







An example of Via creation process scheme

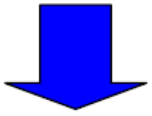


Deep RIE / Bosch process

- **MX5000series** Dry Film Photoresist
- **Zyron®** high purity fluorine containing gases

Resist removal process

- **EKC WLP series** ® Dry Film Remover



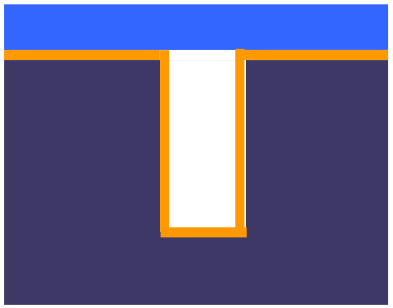
CF deposition removal process

-**Vertrel® XF (C5H2F10)** CF deposition remover
-**EKC265, EKC2255** residue remover

Via Protection & Via Plating

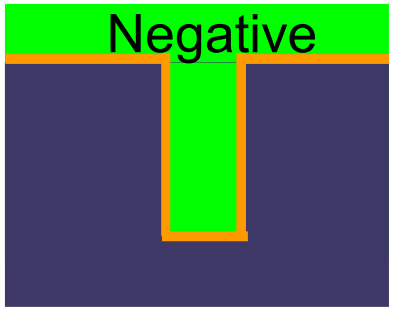
Process limitation of liquid photoresist

Via Tenting
-No PR in
the via



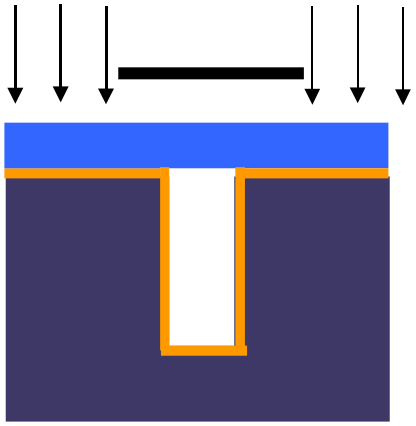
Lamination

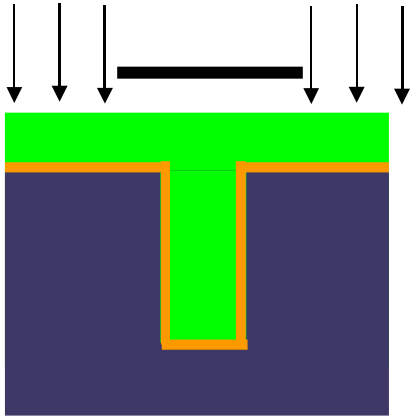
Spin Coat

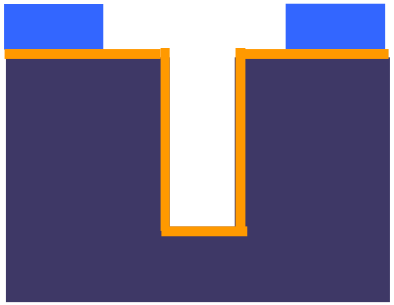


Coating bubbles in via

Silicon Via/Trench

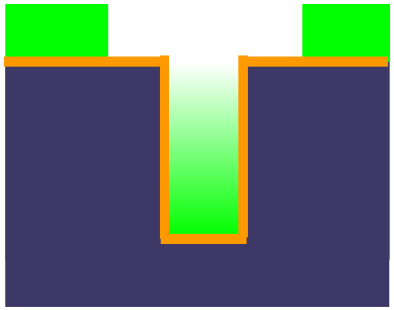






Mild chemical for
Development
- 1% Na2CO3/K2CO3

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

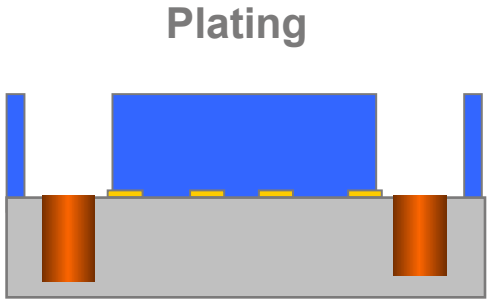


Development residue in via

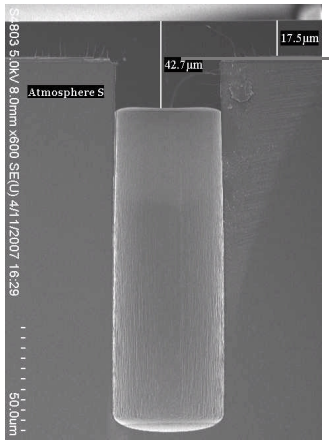
MX5000 series

Via Plating

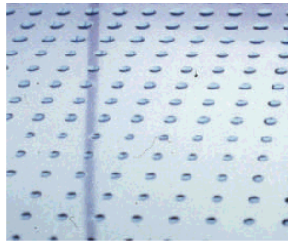
DuPont® MX5000 Dry Film Photoresist



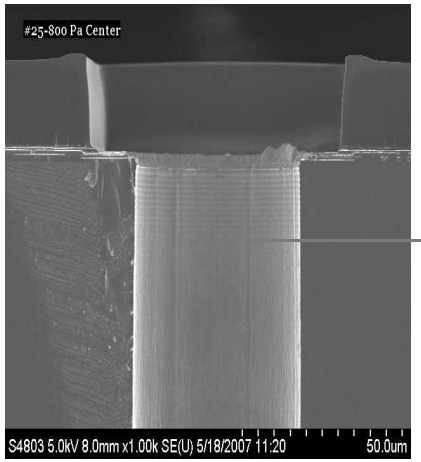
- One step, simple application process
- "Tenting" over vias
- No Residue inside the vias



Dry film "tenting" over existing vias



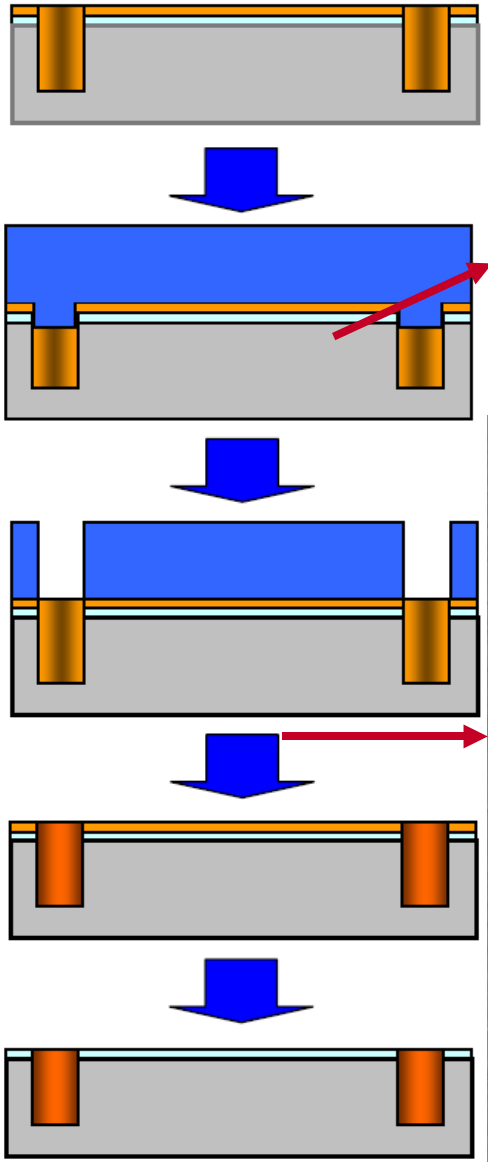
After Lamination

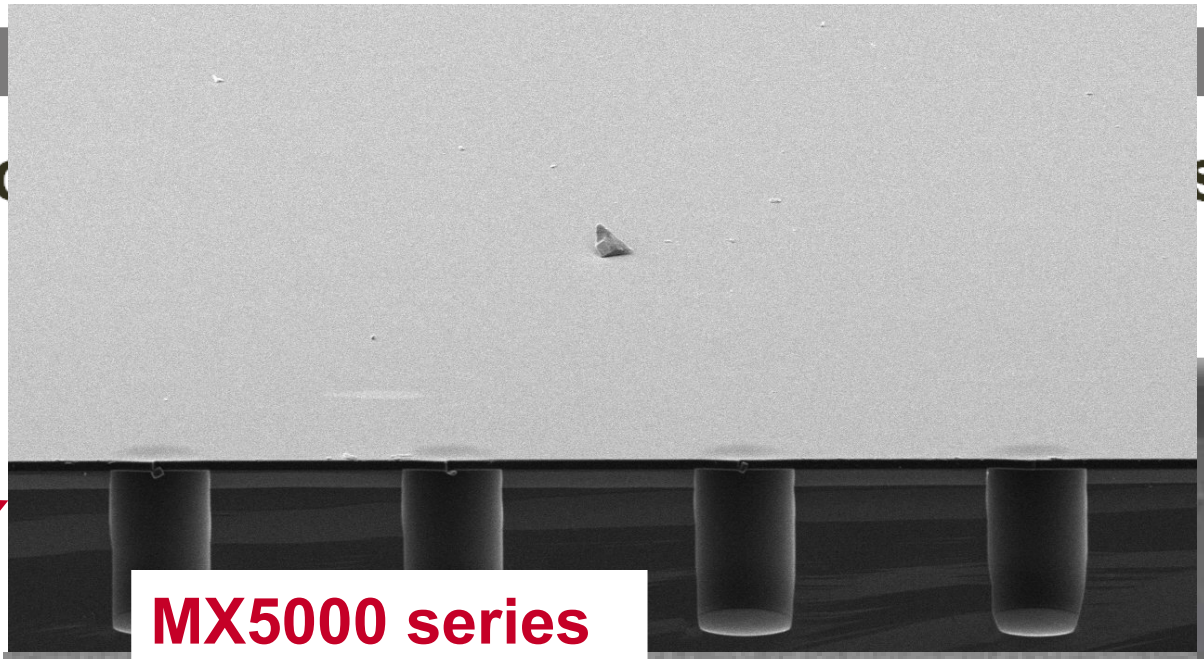


Residue free via ready for plating

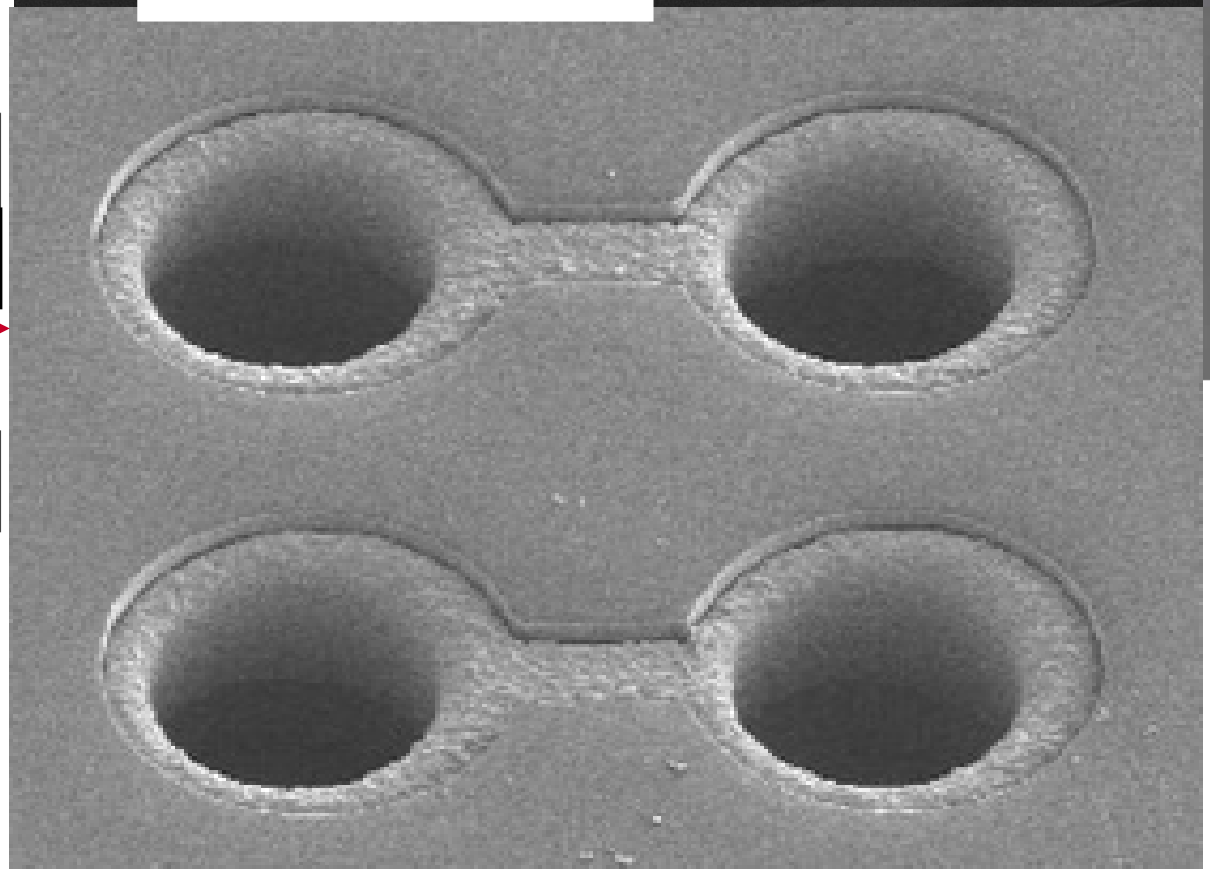
After Developement

An example o st)





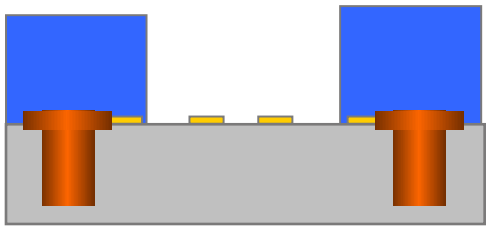
MX5000 series



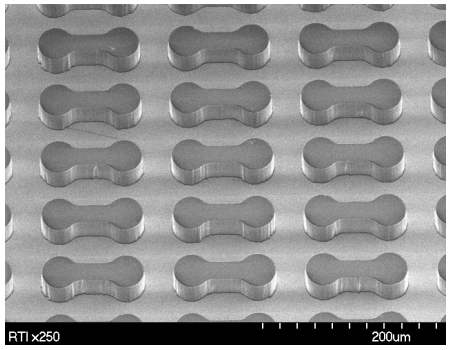
Via Protection

DuPont® MX5000 Dry Film Photoresist

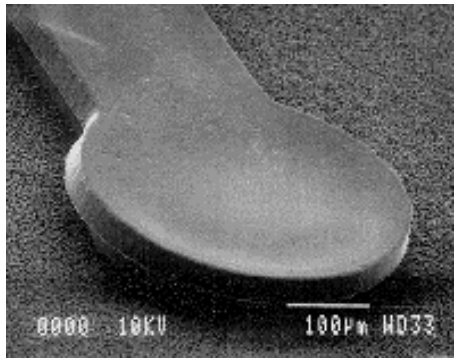
Rerouting



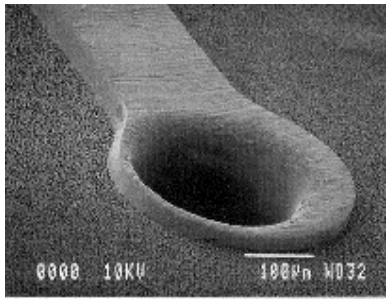
- One step, simple application process
- "Tenting" over vias
- No Residue inside the vias

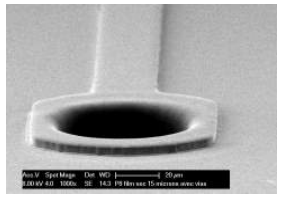


Dog Bone Structure after development

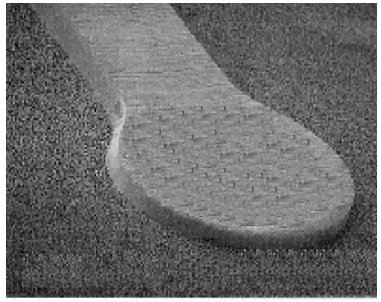


Dog Bone Structure after metal etch





Protected un filled via after removal



Protected filled via after removal

Micro Bump & Cu Pillar

An example of Bump process scheme

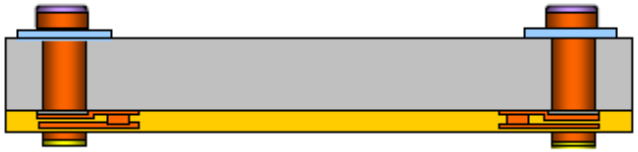
Electric plating process

- **WBR2050 series** Dryfilm Plating mask

Resist removal process

- **EKC WLP series** ® Dry Film Remover

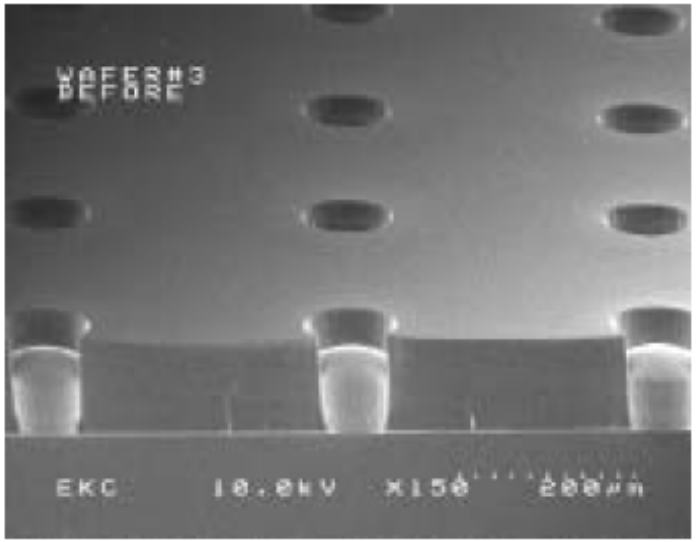
Backside Bump



Re-routing process

- **HD4100/HD8820 series** PI coatings

DuPont® WBR2050 series



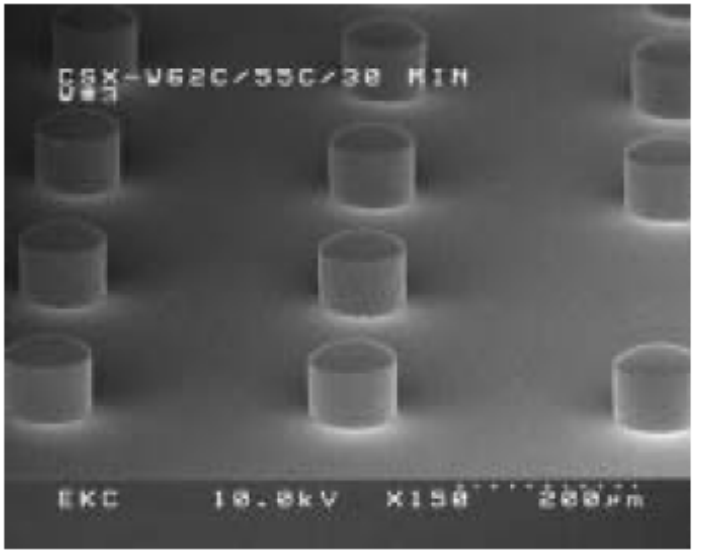
Photoresist:
MPF™WBR50

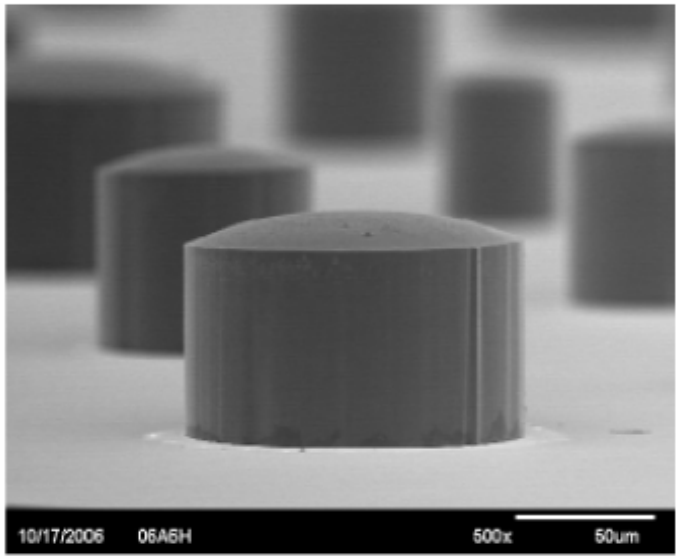
Surface:
Cu

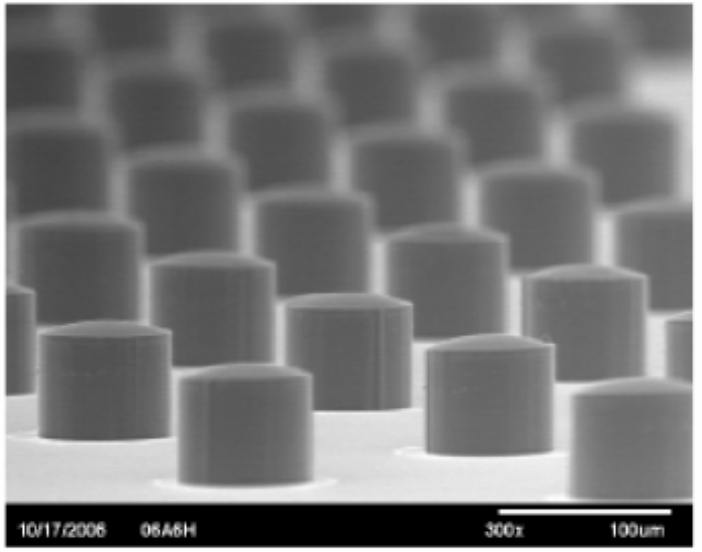
Exposure:
Suss MA200

Plating Eletrolytes:
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!


DUPONT
The miracles of science™