Introduction to the isishape HiperEtch® portfolio:
Innovative Materials for Touch Screen and Flexible
Display Fabrication

SID Exhibitor Forum, Boston, MA, June 5, 2012

EMD Chemicals,
Robert Miller, Business Manager, LC and Emerging Technologies
Agenda

1. Merck (KGaA) is not Merck (& Co.) but EMD
2. Motivation
3. Advantages of isishape®
4. Process description
5. Application examples
6. Summary & final remarks
Merck is not the same as Merck

- Merck KGaA, Darmstadt, Germany and the U.S. pharmaceutical company Merck & Co., New Jersey, USA, have been two independent companies since 1917.

- Common historical roots:
  - 1891 Merck & Co. founded in New York by Georg Merck, a member of the Merck family
  - As a consequence of World War I, Merck & Co. was expropriated and became an independent company.

- Today, Merck & Co. holds the rights to the name within the US and Canada. Merck KGaA and its affiliated group companies operates here as EMD and holds the rights to the name Merck in the rest of the world.

In this presentation “Merck” stands for Merck KGaA, Darmstadt / Germany
Structuring Solutions Merck

Efficient alternative to photo lithography, plasma and/or laser ablation for structuring

- Cut down process steps
- Improve performance
- Environmentally friendly

Easier & faster production, supporting Green Factory approach
One thing in common......

- Layer structuring of semiconductors, passivation or AR-coatings, TCOs
- Sometimes selectively (no impact to the layer underneath)
Possibilities of Structuring

Photo Lithography
- Apply of Photoresist
- Exposure (Layout)
- Developing
- Rinsing
- Etching
- Rinsing
- Stripping
- Drying

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isishape® PROCESS - 1
- Screen printing
- Heating
- Cleaning
- Drying

isishape® PROCESS - 2
- Screen printing
- Cleaning
- Drying

minus 50%
minus 63%
The isishape® process

easy, fast & environmentally friendly

- Less process steps
- High material utilisation
- Minimal investments

- Lowest waste water impact
- Safe working environment
- “Green Factory” concept
isishape® portfolio

<table>
<thead>
<tr>
<th>TCO Layers</th>
<th>Functional and Antireflective Layers</th>
<th>Semiconductors (wafers and layers)</th>
<th>Metal Layers</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITO</td>
<td>SiO₂</td>
<td>c-Si</td>
<td>Al</td>
</tr>
<tr>
<td>IZO</td>
<td>SiNx</td>
<td>a-Si</td>
<td>Ag</td>
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<tr>
<td>AZO</td>
<td>Al₂O₃</td>
<td></td>
<td>Cu</td>
</tr>
<tr>
<td>ZnO</td>
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</tbody>
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The chemical concept enables selective etching of layer systems. Other structuring solutions upon request.
Selective etching is possible

- **Printing**
  - SiO₂
  - ITO
  - SUBSTRATE

- **Etching**
  - SiO₂
  - ITO
  - SUBSTRATE

- **Cleaning**
  - SiO₂
  - ITO
  - SUBSTRATE
**isishape HiperEtch® 11S**

**SiO₂ on ITO/glass**

- **Screen:** Stainless steel
- **Pattern:** Squares
- **Etching:** 3 min at room temperature

**Key features**

- Screen-printable paste
- 100 nm SiO₂ etching on ITO (without ITO damage)
- Etching process for SiO₂ without oven
- Smallest line width 100 µm
- Excellent cleaning for substrates and screens with water
- Very low concentrations of organic compounds and etchant in rinse water
isishape HiperEtch® 18S

50nm ITO/film

- Screen-printable paste
- Qualified for fine line printing and structuring (≤50 µm)
- ITO etching at 100-150°C (surface temperature)
- Excellent wetting behaviour for large area printing.
- Good cleaning of Si-Wafers and screens with water-jet only!
- Environmentally friendly process (no HF, no Cl2)

Screen: stainless steel
Pattern: line pattern
Etching: 120 sec at 120°C (surface temp.)
**isishape® R&D sample 11-S-02**

**Silver nano wire on PET film**

- Screen: Stainless steel
- Pattern: 30 µm
- Etching: 70°C, 5min

**Key features**

- Screen-printable paste
- Structuring of silver nano wires or CNT on PET film at 70-100°C
- Smallest line width 150µm on PET film
- Excellent cleaning of substrates
- Very low concentrations of organic compounds and etchant in water after rinsing
- Environmentally friendly process (no HF, no Cl2)
Service

Material system (layer thickness) and typically pattern dimension

- ITO (130 nm) on glass  40 µm
- ITO (50 nm) on plastic film  50 µm
- SiO₂ (100 nm) on ITO  100 µm
- Al (200 nm)  50 µm

We provide:

- Application support on inline equipment,
- Tailored formulations with customer specific properties including non-contact methods.
Summary

isishape HiperEtch® concept shows many advantages in display applications:

Excellent processing
- Very good line resolution (down to 50 µm)
- Standard equipment for printing, etching and rinsing
- Low material consumption
- Fast structuring time (100 nm / minute)

Environmentally friendly
- Very low organic concentration in rinse water
- Easy cleaning without organic detergent
- isishape HiperEtch® products contain no chlorides
Do you want to structure smart & simple?

isishape®
Advanced Materials for New Production & Application Concepts

Easy, Fast & Environmentally-Friendly

WE WILL SUPPORT YOUR SUCCESS