Cima NanoTech Company Overview

- Multinational team:
  - Headquarters in Minnesota
  - R&D and pilot production in Israel
  - Manufacturing & Marketing JV in Japan with Toda Kogyo
- 11 year R&D history
- 70+ Patents and Patent Applications covering core technical and market areas

Company Focus

Nano Materials for Printed Electronics

1) Nano Silver
2) Nanoparticle Inks
   - Ink jet inks
   - Self assembled coatings of silver emulsions
3) Business strategy:
   - Product development with strategic partners
   - Diverse applications

SANETM Films
**SANTE™ – Self Aligning Nano Technology for Electronics**

- Good Transparency >80% on PET
- Low Sheet Resistance
  - <15Ω/□, <5Ω/□
- High Volume roll-to-roll coating
- Available for various substrates: Glass, PET, PC, PVC, etc.

**Transparent Conductive Coatings**

- Electromagnetic Interference (EMI) Filters
- Displays
  - Touch screen
  - Electrophoretic
  - Electrochromic
- Photovoltaics
  - cSi
  - Thin Film
- Light Sources
  - Inorganic EL
  - OLED
- Transparent Heaters
- Low Emissivity Coatings
- Antistatic Films

**Performance vs. Competition**

<table>
<thead>
<tr>
<th>Film Type</th>
<th>Resistance (Ohms/sq)</th>
<th>Transparency (400-700 nm)</th>
<th>Flexibility</th>
<th>Environmental Stability</th>
<th>Color (b value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thin Indium Tin Oxide</td>
<td>300</td>
<td>85%</td>
<td>Low</td>
<td>High</td>
<td>2.5</td>
</tr>
<tr>
<td>Thick Indium Tin Oxide</td>
<td>30</td>
<td>80%</td>
<td>Low</td>
<td>High</td>
<td>2</td>
</tr>
<tr>
<td>PEDOT: PSS (Nano Particle)</td>
<td>300</td>
<td>80%</td>
<td>High</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>SANTE Films</td>
<td>3.5</td>
<td>80%</td>
<td>High</td>
<td>High</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Plated* SANTE Films</td>
<td>As low as 0.01</td>
<td>≥70%</td>
<td>High</td>
<td>High</td>
<td>Tunable</td>
</tr>
</tbody>
</table>

* SANTE Films may be plated after coating to further enhance resistance.
SANTE Film Contribution Itself

- Most transmitted color is coming from substrate
- For SANTE film itself, less than 0.3% deviation from flat transparency spectrum over 400 – 700nm

SANTE Film – Touch Screen

Example application: Four Wire Touch Screen.

Value:
- Durability
- Cost

SANTE Film – Electroluminescence

Example application: Inorganic EL Lamps

Value:
- Performance improvements
- Critical for large displays
- Lighting uniformity
Plated SANTE Mesh

Imaged from “bottom” of free-standing film

Inversion / Transfer / Flattening

Ag Nanoparticles
Cu Plating

Sacrificial substrate
Adhesive
New substrate

Flexibility and ThermoPlasticity

SANTE™ Film Solar Applications

Unlike R2R work (launching), Cima PV work in infancy.

Models imply 10% improvement in cSi and thin film cell $/kWhr
Lab development proceeding
SANTE™ Film – cSi Solar

- Non contact coating process
  - enables continued wafer thinning and
  - reduces screen print breakage
- Narrow linewidths
  - ~10 um vs 100 um
- High aspect ratios
  - 1:3 vs 1:10

High transparency, conductance (higher efficiency), lower manufacturing cost

SANTE™ Film – Thin Film Solar

Superior Sheet Resistance
(now 1.6 Ω/sq. on glass)

Superior IR Transmittance

Substantial Cost Benefit
- Now Engaging Partners -

Partnerships

- International, integrated & expert supply chain
  - Silver Nanoparticles and Dispersions:
    - Toda Kogyo and Cima Israel
  - PET R2R coating:
    - Toray & others
  - Spray coating
  - Post coating conversion (transfer, molding, etc.):
    - Fujicopian
    - Chiyoda Gravure

Overall Cima / SANTE Film Status

- Rapidly ramping SANTE Films for numerous applications
- Partnerships
  - suppliers
  - customers &
  - research partners
  - are actively sought.

Technology Pioneer Award 2008

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