The Overflow Downdraw Process

• First patented in 1967 [Dougherty 3,338,696]
• Overflow process assures outside surfaces are virgin
• No distortion due to hydrostatic or feeding pressures, glass feed pressure is low.
• Overflow trough is a metering weir that assures uniform glass thickness
  – Tapered trough bottom
  \[ \frac{Q}{\tan \phi} = K \]
Controlling Glass Thickness

- Temperature control key to thickness control
- Many air jets control temperature to maintain thickness
  - Opposing jets are staggered to provide best coverage
  - Jets can heat or cool glass to make glass thicker or thinner
- Key process element is feedback loop between measurement and air flow rates and temperature
  - Laser micrometers measure thickness
  - Feedback loop using PID controllers
## Flat Panel Compositions

<table>
<thead>
<tr>
<th>Glass</th>
<th>SiO2</th>
<th>Al2O3</th>
<th>B2O3</th>
<th>MgO</th>
<th>CaO</th>
<th>SrO</th>
<th>As2O3</th>
<th>BaO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Density</td>
<td>69.3</td>
<td>10.6</td>
<td>9.97</td>
<td>0.18</td>
<td>9.58</td>
<td>0</td>
<td>0.37</td>
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<td>1992-87</td>
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<td>9</td>
<td>4</td>
<td>13</td>
<td>3</td>
<td>7</td>
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<td>1994-95</td>
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<td>11</td>
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<tr>
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<td>15</td>
<td></td>
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<td>24</td>
</tr>
</tbody>
</table>

- TiO2
- Ta2O5
- Nb2O5
Complete Viscosity Curve and Critical Properties of Corning Active Matrix Overflow Downdraw Glass

[Low Density, Silicon Matched Expansion]

Critical Property Summary
- Strain Point = 668
- Softening Point = 992
- Annealing Point = 726
- Density = 2.336
- Melting Point = 1747
- Melting Temperature (Corning) = 1674
- Liquidus Temperature = 1100
- Liquidus Viscosity = 1.12 e+6 poise
- Expansion = 31.4 x 10^-7
- Durability in HF(50%)/NH4F(40%) (1/10), 5 min, 30 degrees = 0.2 mg/cm^2

A little high melting
But has the necessary strain point for TFT processing on polysilicon

AMO LCD GLASS SHARE (Area Basis) Q1’01 - Q1’02

Courtesy of DisplaySearch Inc.

Corning and Asahi Glass gained ground due to NH7’s fab closures and NEG’s loss of share.

[July '02 DisplaySearch Inc.]
Glass Substrate Shipments

Glass substrate shipments rose 65% Y/Y and 9% Q/Q to 4.4 million square meters.