Outline

- **Need of soft pads**
  - Driving force – defects

- **Challenges of soft pads**
  - Usable pad life
  - Process stability – rate, selectivity, topography
  - Batch to batch variation

- **CMC approach to soft pads**
  - Why thermoplastic pads?
  - Manufacturing technology advantage

- **Pads for barrier application**
  - Test results for pad stability and defects
Why Soft Pads?

- **Defects: Particle and scratches**
  - Slurry: complex designs to control selectivity for topography
    - New designs, new materials, new requirements
    - Pad first or slurry first – difficult choice
  - Pad should be capable to remove residue and avoid scratch
    - Challenge is how to achieve integration requirement while maintaining low defects

- **Process knobs for pads**
  - Shore hardness – measure of resistance to indentation
    - Softer material leads to lower defects, but poor topography
  - Material hardness – resilience, modulus
    - Higher resilience and lower modulus helps lower defects
  - Pore structure – slurry holding capability, compressibility
    - Higher slurry holding capability leads to lower particle and scratch defects
  - Abrasion resistance – pad life
    - Pad life should be similar to hard pad/bulk polish step
Why Thermoplastic?

**Thermoset vs. Thermoplastic**
- For soft material, differences of TPU vs. TSU are small – cross linking absent in both cases
- No metal contamination, or additives in thermoplastic material
- \((\text{Isocyanate})_1\text{ mole} + (\text{diol + Polyol})_1\text{ mole}\) → polyurethane
  - Tight stoichiometry control of components will lead to non-cross linked TPU
- Hydrolysis resistant, low abrasion

**CMC Foaming Technology**
- Non-chemical blowing agent technology
- Solid State Foaming
  - CO₂ saturated sheet is removed and is exposed to foaming conditions (above Tg)
  - Microcellular structure is formed as a result of system responding to CO₂ escape (nucleation and growth)
<table>
<thead>
<tr>
<th>Porosity</th>
<th>25D</th>
<th>42D</th>
<th>50D</th>
<th>60D</th>
<th>72D</th>
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<tbody>
<tr>
<td>Very High (&gt;60%)</td>
<td>F99</td>
<td></td>
<td>F66</td>
<td></td>
<td>F33</td>
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<tr>
<td>High (40-50%)</td>
<td>F12</td>
<td>F9</td>
<td>F8</td>
<td>F6</td>
<td>F3</td>
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<tr>
<td>Medium (20%-40%)</td>
<td></td>
<td>F7</td>
<td>F5</td>
<td>F2</td>
<td></td>
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<tr>
<td>Low (&lt;20%)</td>
<td>F11</td>
<td>F10</td>
<td>F4</td>
<td>F1 / D100</td>
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</tr>
</tbody>
</table>
CMC Soft Pad Portfolio

- Resin
  - 87 A, 70A
  - Window: FullVision®

- Porosity
  - Low
    - 10 ± 5
  - Medium
    - 30 ± 5
  - High
    - 70 ± 5*

- Pore size
  - Small
    - 20 ± 10
  - Medium
    - 40 ± 10
  - Large
    - 60 ± 10

- Surface
  - Smooth

- Grooves
  - XY
  - Conc.
  - Combo
D2xx Process Flow

1. **Polycarbonate substrate**
   - Extrusion
   - Top Pad Foam & Sheeting
   - Lamination
   - Lamination Adhesive
   - Die-cut
   - Window Insertion (optional)
   - Grooving
   - Cleaning, Bagging
   - Packaging (Box)
   - Quality Data Verification (CoA)
   - Ship

2. **Surfacing**
   - Backside
   - Topside

3. **Platen Adhesive**
   - Injection Mold Window

4. **TPU Resin**
Defectivity vs. Porosity

- Higher porosity pad has lower storage modulus and higher compressibility.
  - Better defects, higher rate
Polishing Rate Stability

- High porosity pads lead to high rate and lower defects
  - Ideal candidate for barrier process
  - Stable and long pad life
**FullVision™* Window**

- **Window Technology**
  - Unique window installation technology – TPU advantage
  - Welded windows, 100% leak tested
  - Capable to match pad resin hardness with FV window
  - UV stabilized material to ensure stable performance over pad life
  - Window hardness – match to pad resin hardness

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Thank You