SHADOW industries

Engineering with a Purpose
Polyshot Brazed Core Mold Flow Analysis Project

Prepared for:

Doug Hepler
Polyshot Corporation
West Henrietta, New York
The purpose of this mold flow study was to evaluate the manufacturing performance change in a single cavity simple Cap mold with conformal cooling utilizing Polyshot’s brazed core technology and one utilizing a standard baffle design.

Both scenario’s inputs were identical with the exception of the mold insert and cooling configuration.
Finite Element Mesh – Tetra / Prismatic Mixed

- 622,301 Part elements
- 1,074,897 Cooling elements
- 2,949,503 Mold elements

Project: STX-50-001-2012
## Material Properties (PP – Sabic 575P)

*Units = English*

### Table of Mechanical Properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elastic Modulus</td>
<td></td>
<td>26,172 (psi)</td>
</tr>
<tr>
<td>Poisson Ratio</td>
<td></td>
<td>0.38</td>
</tr>
<tr>
<td>GLTE</td>
<td></td>
<td>5.65556-005</td>
</tr>
</tbody>
</table>

### Diagrams

- **Viscosity vs. Shear Rate**: Graph showing viscosity plotted against shear rate.
- **Specific Volume vs. Temperature**: Graph showing specific volume plotted against temperature.

### Process Conditions

- Melt temperature (minimum): 410°F
- Melt temperature (normal): 484°F
- Melt temperature (maximum): 518°F
- Mold temperature (minimum): 68°F
- Mold temperature (normal): 104°F
- Mold temperature (maximum): 140°F
- Ejection temperature: 294°F
- Freeze temperature: 330°F

### Notes

- Project: STX-50-001-2012
- SHADOW industries
**Project:** STX-50-001-2012

**Processing Conditions**  
01/07/2013

### Filling
- Filling time (sec): 0.25
- Melt Temperature (oF): 464
- Mold Temperature (oF): 104
- Maximum injection pressure (Psi): 20000
- Injection volume (in^3): 0.568075

### Packing
- Packing Time (sec): 1
- Maximum packing pressure (Psi): 20000

### Cooling
- Cooling Time (sec): 5
- Mold-Open Time (sec): 3
- Eject Temperature (oF): 293.63
- Air Temperature (oF): 77

### Miscellaneous
- Cycle time (sec): 9.25
- Mesh file: Cap-Tetra-Conformal_m2.mfe
- Material file: PB-0120257750_1.mfe

**Cooling Channel**

<table>
<thead>
<tr>
<th>Channel ID</th>
<th>T (oF)</th>
<th>Q (in^3/sec)</th>
<th>Coolant</th>
<th>D (in)</th>
<th>Re</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC1 (Group 1)</td>
<td>80.0001</td>
<td>7.7</td>
<td>Water</td>
<td>0.31496</td>
<td>23292.2</td>
</tr>
</tbody>
</table>

- **Units = English**

- **70% of machine capacity of 20 ksi**
- **80% of EOF Pressure**
Filling Pattern @ EOP

01/07/2013

Baffle

Conformal

Animation will play when shown as a slide show.
Part Temperature at End of Packing Phase

36% lower

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Conformal

Project: STX-50-001-2012
Part Temperature at End of Cooling Phase

38% lower Denotes a faster cycle

Baffle

Conformal
Mold Temperature at End of Cooling Phase (Cross Section View) 01/07/2013

Temperature difference resulted in a **39%** reduction in cycle time.

Req'd Cooling Time 3.1 sec

Req'd Cooling Time 1.9 sec

Showing much cooler mold inserts when results are scaled to identical values.
Mold Temperature at End of Cooling Phase – Detail View

Showing much cooler mold inserts when results are scaled to identical values

Temperature difference resulted in a 39% reduction in cycle time.

Req’d Cooling Time 3.1 sec

Temperature

Cooling_Temperature

x10 0 [°F]

270.594

250.052

245.510

232.968

220.426

207.884

195.342

182.800

170.258

157.716

145.174

132.632

120.090

107.548

95.006

82.464

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Conformal
Coolant Temperature at End of Cooling Phase

01/07/2013

99% lower temperature rise in coolant during the cooling phase. Greater cooling efficiency.
Coolant Pressure at End of Cooling Phase

98% higher coolant pressure during the cooling phase. Greater cooling efficiency.
Total Displacement (Warpage) after Ejection at Room Temp

5X Magnification

25% lower total warpage (all effects included)

Baffle

Conformal

Project: STX-50-001-2012
Total Displacement (Warpage) after Ejection at Room Temp

10X Magnification

25% lower total warpage (all effects included)

Baffle

Conformal
Total Displacement (Warpage) after Ejection at Room Temp

5X Magnification

25% lower total warpage (all effects included)

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Conformal
Contact Information

Robert A. Hickman
President

Shadow Polymer Industries, Inc.
Houston, Texas

(281) 789-7520 office
(330) 224-5640 cell

Rob@shadowpolymer.com

For more information, visit us online at:

www.shadowpolymer.com