Autodesk

Autodesk Moldflow Plastics Labs

Material Testing Report

SN 6374

Isofil K 20 T YLO232

Lot # S1044019827

Prepared for:

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Prepared by:

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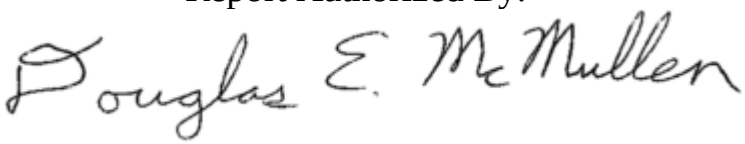
Prepared on:

1 March, 2012

Report Authorized By:



Douglas McMullen

Laboratory Technician

1 March, 2012

ACCREDITED

Testing Cert. 2399.01

Moldflow Plastics Labs is accredited by the American Association for Laboratory Accreditation, and maintains a quality system in accordance with ISO/IEC 17025. Tests performed outside the scope of accreditation are duly noted.

Contents

Summary

Description

Family name	POLYPROPYLENES (PP)
Trade name	Isofil K 20 T YLO232
Manufacturer	Sirmax SpA
Family abbreviation	PP
Material structure	Crystalline
Data source	Autodesk Moldflow Plastics Labs : pvT-Measured : mech-Measured
Date last modified	29-FEB-12
Date tested	16-FEB-12
Data status	Non-Confidential
Material ID	30671
Grade code	SN6374
Supplier code	SIRMAX
Fibers/fillers	20% Talc Filled

Recommended Processing

Mold surface temperature	35	°C
Melt temperature	238	°C

Mold temperature range (recommended)		
Minimum	20	°C
Maximum	50	°C

Melt temperature range (recommended)		
Minimum	220	°C
Maximum	245	°C

Absolute maximum melt temperature	265	°C

Ejection temperature	116	°C

Maximum shear stress	0.25	MPa
Maximum shear rate	100000	1/s

Maximum shear stress and maximum shear rate values have been supplemented with generic estimates.

Rheological Properties

Cross WLF Viscosity Model		
n	0.30513	
Tau	29078.5	Pa
D1	4.01665e+014	Pa-s
D2	263.15	K
D3	0	K/Pa
A1	32.260	
A2	51.600	K

Juncture loss method coefficients		
C1	1.013e-005	Pa^(1-c2)
C2	2.136	

Transition temperature		
Ttrans	126	°C

Moldflow Viscosity Index	VI(240)78	

Melt mass-flow rate (MFR)		
Temperature		°C
Load		Kg
Measured MFR		g/10min

Thermal Properties

Specific heat data		
Temperature (T) °C	Specific heat (Cp) J/Kg-°C	Heating/Cooling rate °C/s
233	2458.0	-0.33
200	2355.0	-0.33
170	2275.0	-0.33
133	2179.0	-0.33
128	2461.0	-0.33
126	3921.0	-0.33
123	10883.0	-0.33
120	8522.0	-0.33
116	3739.0	-0.33
111	2443.0	-0.33
99	2147.0	-0.33
58	1743.0	-0.33

Thermal conductivity data		
Temperature (T) °C	Thermal conductivity (k) W/m-°C	Heating/Cooling rate °C/s
240	0.199	0.0
222	0.197	0.0
203	0.202	0.0
184	0.200	0.0
165	0.203	0.0
146	0.211	0.0
127	0.258	0.0
107	0.259	0.0
86	0.256	0.0
66	0.261	0.0
45	0.259	0.0
29	0.278	0.0

PVT Properties

Melt density	0.8725	g/cm^3
Solid density	1.0628	g/cm^3

2-domain Tait PVT model coefficients		
b5	441.15	K
b6	7.250e-008	K/Pa
b1m	0.001091	m^3/Kg
b2m	7.866e-007	m^3/Kg-K
b3m	9.88013e+007	Pa
b4m	0.005901	1/K
b1s	0.001007	m^3/Kg
b2s	4.634e-007	m^3/Kg-K
b3s	1.60378e+008	Pa
b4s	0.005848	1/K
b7	0.000084	m^3/Kg
b8	0.097203	1/K
b9	1.089e-008	1/Pa

Mechanical Properties

Mechanical properties data		
Elastic modulus, 1st principal direction [E1]	2408	MPa
Elastic modulus, 2nd principal direction [E2]	2341	MPa
Poisson's ratio [v12]	0.3690	
Poisson's ratio [v23]	0.3690	
Shear modulus [G12]	792	MPa

Transversely isotropic coefficient of thermal expansion [CTE] data		
Alpha1	7.540e-005	1/°C
Alpha2	7.990e-005	1/°C

Shrinkage Properties

Corrected residual in-mold stress (CRIMS) model coefficients	
A1	0.657514
A2	-0.110524
A3	0.004268
A4	1.023916
A5	-0.453646
A6	0.004751

Residual strain model coefficients		
	Parallel	Perpendicular
A1	0.078784	0.13422
A2	0.003109	0.003626
A3	-0.000072	-9.3533e-006
A4	1.1505e-007	3.9103e-007
A5	0.002683	0.002307

The shrinkage models shown above are valid for Autodesk Moldflow Insight 2012. Shrinkage models for previous software versions are included in the 21000.udb file.

Filler Properties

Filler data	
Description	Weight %
Talc	20

Viscosity

Method:
MPL Test Method
(Method falls outside the scope of A2LA Accreditation)

Instrument:
Arburg Allrounder 270S Injection Molding Machine

Test Specifications:

Sample Form:		Pellets
Pre-Processing:		Dried at 85°C for 4 hours in a hopper dryer
Moisture Level:		Not Measured
Capillary A:	Length:	32.4214 mm
	L/D:	16.2107
	Die Entry Angle:	90 degrees
Capillary B:	Length:	8.0787 mm
	L/D:	4.03935
	Die Entry Angle:	90 degrees
Barrel Diameter:		30 mm
Plastication Time:		20 sec
Dwell Time:		20 sec
Corrections:		Bagley, Rabinowitsch and shear heating
Date Received:		04-NOV-11
Date Tested:		09-FEB-12

Operator's Notes:
Testing was performed per standard testing procedures.
No anomalies were noted during the course of testing.

Apparent Viscosity Data

Temperature (°C)	Apparent Shear Rate (sec^{-1})	Apparent Viscosity (Pa-s)	Die Diameter (mm)	Die L/D
188.3	184	465.38	2	16.21
188.8	784	166.76	2	16.21
188.8	26760	16.29	2	16.21
188.9	315	313.86	2	16.21
188.9	13116	24.75	2	16.21
189.4	1401	110.51	2	16.21
190.2	2692	70.2	2	16.21
191.6	6744	37.55	2	16.21
208.5	182	375.92	2	16.21
208.7	310	261.91	2	16.21
208.8	784	140.08	2	16.21
208.8	26585	13.54	2	16.21
208.9	1409	93.32	2	16.21
208.9	66004	8.34	2	16.21
209.7	2683	60.28	2	16.21
209.8	13187	20.91	2	16.21
210.1	6715	32.48	2	16.21
223.6	181	339.88	2	16.21
223.8	308	237.93	2	16.21
223.8	26593	12.04	2	16.21
223.9	66670	6.94	2	16.21
224.1	6710	27.34	2	16.21
224.5	1400	85.16	2	16.21
224.8	795	125.09	2	16.21
224.8	2685	54.76	2	16.21
225.5	13226	18.79	2	16.21
238.7	66024	6.22	2	16.21
238.8	26423	11.03	2	16.21
239	13157	17.33	2	16.21
239.6	309	214.77	2	16.21
239.8	785	115.88	2	16.21
239.8	1390	78.72	2	16.21
239.8	2671	50.65	2	16.21
240.5	6733	26.98	2	16.21
193.2	315	336.06	2	4.04
193.2	784	201	2	4.04
193.9	26760	28.43	2	4.04
194	1401	143.03	2	4.04
194	13116	41.32	2	4.04
194.3	184	457.94	2	4.04
194.6	2692	98.03	2	4.04
195.8	6744	58.34	2	4.04
196.9	66868	16.95	2	4.04
213.5	1409	113.46	2	4.04
213.6	784	156.9	2	4.04
213.8	310	252.96	2	4.04
214	2683	79.41	2	4.04
214.2	6715	48.2	2	4.04
214.3	13187	34.1	2	4.04
215	182	328.08	2	4.04
215	26585	23.98	2	4.04

Temperature (°C)	Apparent Shear Rate (sec^{-1})	Apparent Viscosity (Pa-s)	Die Diameter (mm)	Die L/D
215.1	66004	15.17	2	4.04
229.3	795	131.58	2	4.04
229.5	308	210.8	2	4.04
229.5	1400	97.7	2	4.04
229.5	2685	68.73	2	4.04
230	26593	20.76	2	4.04
230.3	13226	29.33	2	4.04
230.8	181	266.33	2	4.04
230.9	66670	13.06	2	4.04
245	2671	60.64	2	4.04
245.1	1390	85.32	2	4.04
245.4	785	113.71	2	4.04
246	309	172.93	2	4.04
246	6733	36.71	2	4.04
246	13157	25.87	2	4.04
247	188	203.72	2	4.04
247	26423	18.36	2	4.04
247	66024	11.64	2	4.04

Calculated Viscosity Data

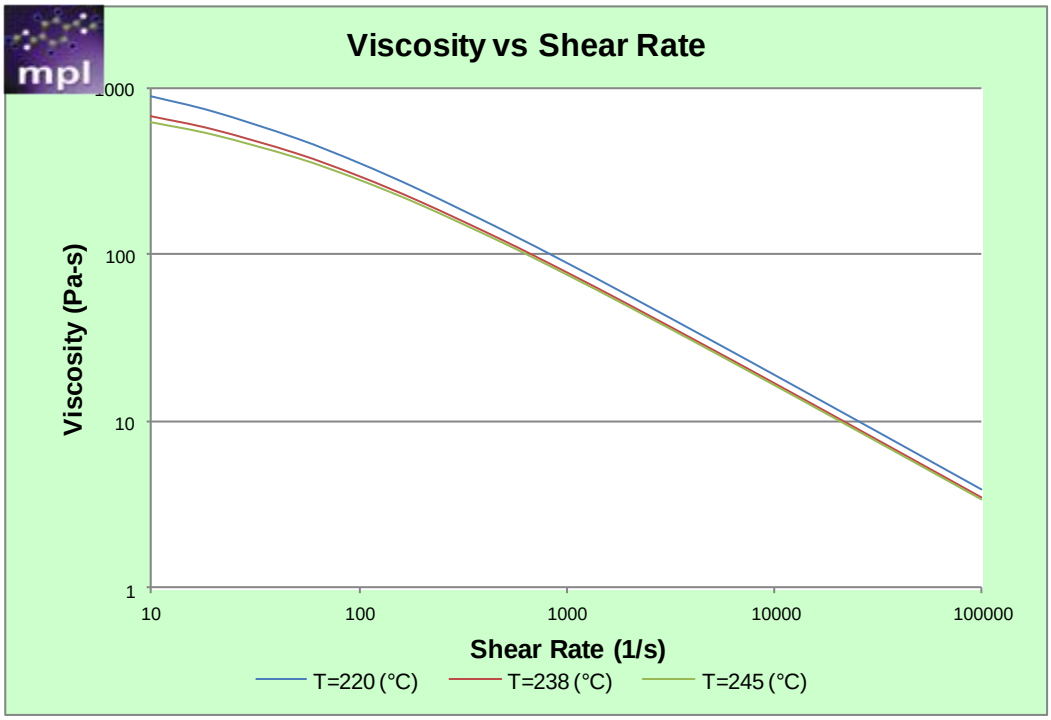
Temperature (°C)	Shear Rate (sec^{-1})	Calculated Viscosity (Pa-s)
188.3	184	346.4
188.8	784	135.69
188.8	26760	12.17
188.9	315	245.7
188.9	13116	19.91
189.4	1401	91.54
190.2	2692	58.41
191.6	6744	30.8
193.2	315	235.87
193.2	784	130.53
193.9	26760	11.68
194	1401	88.03
194	13116	19.11
194.3	184	326.05
194.6	2692	56.33
195.8	6744	29.78
196.9	66868	6.05
208.5	182	286.09
208.7	310	207.1
208.8	784	114.69
208.8	26585	10.51
208.9	1409	77.87
208.9	66004	5.6
209.7	2683	50.25
209.8	13187	16.92
210.1	6715	26.84
213.5	1409	75.23
213.6	784	110.46
213.8	310	198.19
214	2683	48.71
214.2	6715	26.08
214.3	13187	16.4
215	182	269.34
215	26585	10.07
215.1	66004	5.36
223.6	181	250.01
223.8	308	183.03
223.8	26593	9.5
223.9	66670	5.03
224.1	6710	24.42
224.5	1400	69.82
224.8	795	100.66
224.8	2685	45.19
225.5	13226	15.21
229.3	795	97.45
229.5	1400	67.46
229.5	308	174.79
229.5	2685	43.81
230	26593	9.14
230.3	13226	14.76
230.8	181	234.7

Temperature (°C)	Shear Rate (sec^{-1})	Calculated Viscosity (Pa-s)
230.9	66670	4.82
238.7	66024	4.64
238.8	26423	8.72
239	13157	14.06
239.6	309	161.18
239.8	1390	63.33
239.8	2671	41.2
239.8	785	91.33
240.5	6733	22.02
245	2671	39.92
245.1	1390	61.25
245.4	785	87.98
246	309	153.54
246	6733	21.33
246	13157	13.52
247	188	200.63
247	66024	4.43
247	26423	8.33

Rheological Data

Cross WLF Viscosity Model		
n	0.30513	
Tau	29078.5	Pa
D1	4.01665e+014	Pa-s
D2	263.15	K
D3	0	K/Pa
A1	32.260	
A2	51.600	K

Juncture loss method coefficients		
C1	1.013e-005	Pa^(1-c2)
C2	2.136	



Thermal conductivity

Method:

ASTM D 5930, Standard Test Method for Thermal Conductivity of Plastics by Means of a Transient Line-Source Technique.

Instrument:

Moldflow K-System II

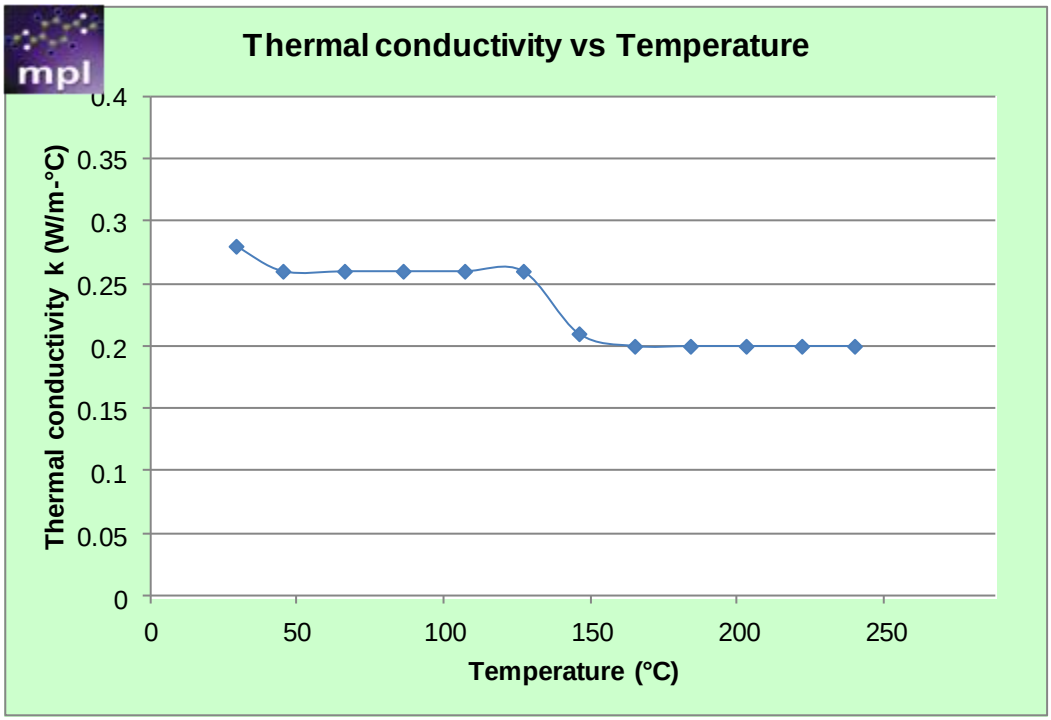
Test Specifications:

Sample Form:	Pellets
Pre-Processing:	Dried at 85°C for 4 hours in a hopper dryer
Moisture Level:	Not Measured
Probe Constant:	0.8065
Probe Length:	45 mm
Data acquisition time:	45 sec
Probe Voltage:	3.0 V
Date Received:	04-NOV-11
Date Tested:	09-FEB-12

Operator's Notes:

Testing was performed per standard testing procedures.
No anomalies were noted during the course of testing.

Thermal conductivity data		
Temperature (T) °C	Thermal conductivity (k) W/m-°C	Heating/Cooling rate °C/s
240	0.199	0.0
222	0.197	0.0
203	0.202	0.0
184	0.200	0.0
165	0.203	0.0
146	0.211	0.0
127	0.258	0.0
107	0.259	0.0
86	0.256	0.0
66	0.261	0.0
45	0.259	0.0
29	0.278	0.0



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Specific heat

Method:

ASTM E 1269, Standard Test Method for Determining Specific Heat Capacity by Differential Scanning Calorimetry
ASTM D 3418, Standard Test Method for Transition Temperatures and Enthalpies of Fusion and Crystallization of Polymers by Differential Scanning Calorimetry

Instrument:

Perkin Elmer Pyris Diamond Differential Scanning Calorimeter

Test Specifications:

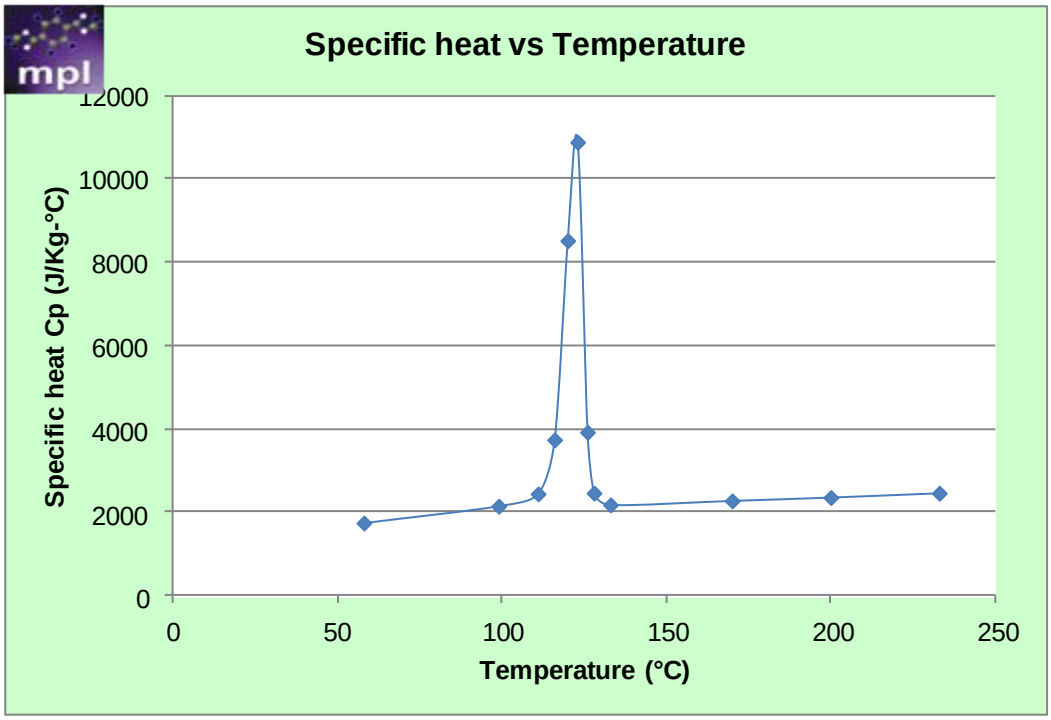
Sample Form:	Pellets
Pre-Processing:	Dried at 85°C for 4 hours in a hopper dryer
Moisture Level:	Not Measured
Initial Temperature:	245°C
Final Temperature:	40°C
Cooling Rate:	20°C/min
Equilibrium Time:	2 min
Sample holder material:	Aluminum
Sample holder dimensions:	6.7 mm diameter, 1.6 mm tall
Sample holder mass:	25 mg (pan + lid)
Purge gas:	99.99% pure nitrogen
Purge gas flow rate:	30 cm^3/sec
Date Received:	04-NOV-11
Date Tested:	09-FEB-12

Operator's Notes:

Testing was performed per standard testing procedures.
No anomalies were noted during the course of testing.

Specific heat data		
Temperature (T) °C	Specific heat (Cp) J/Kg-°C	Heating/Cooling rate °C/s
233	2458.0	-0.33
200	2355.0	-0.33
170	2275.0	-0.33
133	2179.0	-0.33
128	2461.0	-0.33
126	3921.0	-0.33
123	10883.0	-0.33
120	8522.0	-0.33
116	3739.0	-0.33
111	2443.0	-0.33
99	2147.0	-0.33
58	1743.0	-0.33

Ttrans	126	°C
Ejection temperature	116	°C



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Pressure-Volume-Temperature

Method:
High Pressure Indirect Dilatometry

Instrument:
Gnomix pvT Apparatus

Test Specifications:

Sample Form**:**	Molded Plaque
Pre-Processing**:**	Not required
Scan type**:**	Isothermal Cooling
Date Received:	04-NOV-11
Date Tested**:**	13-FEB-12

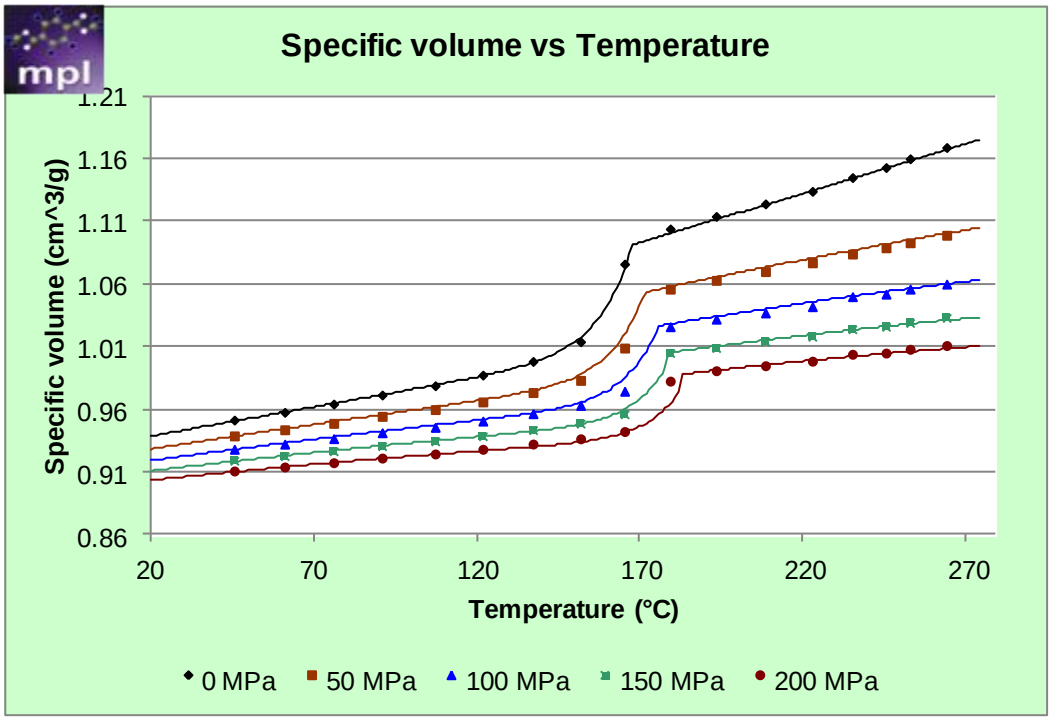
Operator's Notes:
Testing was performed per standard testing procedures.
No anomalies were noted during the course of testing.

pvT Experimental Data

Temperature (°C)	Pressure (MPa)				
	0MPa	50MPa	100MPa	150MPa	200MPa
45.56	0.9515	0.9389	0.9282	0.9191	0.9109
61.01	0.9577	0.9438	0.9323	0.9227	0.9141
76.04	0.9643	0.9489	0.9367	0.9266	0.9175
90.92	0.9715	0.9545	0.9414	0.9307	0.9212
107.2	0.9789	0.9599	0.9457	0.9345	0.9245
121.8	0.9874	0.9660	0.9507	0.9386	0.9282
137.2	0.9983	0.9735	0.9566	0.9435	0.9324
151.8	1.0140	0.9832	0.9632	0.9487	0.9366
165.3	1.0760	1.0090	0.9745	0.9561	0.9424
179.3	1.1040	1.0560	1.0260	1.0050	0.9826
193.4	1.1140	1.0630	1.0320	1.0090	0.9909
208.5	1.1240	1.0700	1.0370	1.0140	0.9949
222.9	1.1340	1.0770	1.0420	1.0180	0.9985
235.2	1.1450	1.0840	1.0500	1.0240	1.0040
245.5	1.1530	1.0890	1.0520	1.0260	1.0050
252.9	1.1600	1.0930	1.0560	1.0290	1.0080
264.1	1.1690	1.0990	1.0600	1.0330	1.0110

Melt density	0.8725	g/cm^3
Solid density	1.0628	g/cm^3

2-domain Tait PVT model coefficients		
b5	441.15	K
b6	7.250e-008	K/Pa
b1m	0.001091	m^3/Kg
b2m	7.866e-007	m^3/Kg-K
b3m	9.88013e+007	Pa
b4m	0.005901	1/K
b1s	0.001007	m^3/Kg
b2s	4.634e-007	m^3/Kg-K
b3s	1.60378e+008	Pa
b4s	0.005848	1/K
b7	0.000084	m^3/Kg
b8	0.097203	1/K
b9	1.089e-008	1/Pa



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Shrinkage

Method:

MPL Shrinkage Test Method (QOP-17-M)
(Method falls outside the scope of A2LA Accreditation)

Instrument:

Krauss Maffei KM160-750CX Injection molding machine
Test mold inscribed with a fine grid pattern
Temperature and Humidity Controlled Room
OGP Smartscope Flash 400 metrology system

Test Specifications:

Sample Form**:**	Pellets
Pre-Processing**:**	Dried at 85°C for 4 hours in a hopper dryer
Moisture Level**:**	Not Measured
Date Molded**:**	09-FEB-12
Post-Processing**:**	Conditioned at 23°C / 50% relative humidity for 7 days
Date Measured**:**	16-FEB-12
Shrinkage Data Correlated With**:**	Autodesk Moldflow Insight 2012
Default Model**:**	Residual Stress (CRIMS)
Date Received:	04-NOV-11

Operator's Notes:

Testing was performed per standard testing procedures.
No anomalies were noted during the course of testing.
Shrinkage measurements have been corrected to account for mold thermal expansion.
Data for some process conditions may have been removed in the determination of the favored model.

Shrinkage Experimental Data

Process Condition	Melt Temperature (°C)	Mold Temperature (°C)	Flow Rate (cc/sec)	Part Thickness (mm)	Packing Pressure (MPa)	Packing Time (sec)	Cooling Time (sec)
1	232.2	45.2	33.4	2	19.7	18	10
2	232.6	46.7	35.3	2	50.0	18	10
3	232.7	41.2	35.3	2	80.6	18	10
4	232.6	43.3	18.1	2	49.9	18	10
5	232.6	47.5	60.5	2	50.1	18	10
6	220.8	43.3	33.4	2	19.6	18	10
7	220.5	40.1	35.3	2	50.0	18	10
8	220.0	46.5	36.3	2	80.6	18	10
9	220.3	41.2	17.6	2	49.9	18	10
10	220.2	42.4	57.7	2	50.1	18	10
11	242.8	46.4	33.4	2	19.6	18	10
12	242.1	42.1	36.3	2	50.1	18	10
13	241.7	42.1	34.3	2	80.6	18	10
14	241.4	47.0	17.6	2	50.0	18	10
15	241.7	44.7	60.5	2	50.1	18	10
16	231.2	42.8	30.7	1.5	19.7	15	10
17	231.2	39.0	32.8	1.5	50.0	15	10
18	231.1	45.1	30.7	1.5	80.5	15	10
19	230.9	43.8	15.9	1.5	49.9	15	10
20	231.2	39.3	50.1	1.5	50.1	15	10
21	231.2	42.2	36.3	3	19.6	30	10
22	231.1	42.8	39.2	3	39.9	30	10
23	230.9	45.8	40.9	3	60.2	30	10
24	231.3	40.7	20.0	3	39.8	30	10
25	231.4	46.9	64.1	3	39.9	30	10

Part Shrinkage

Process Condition	Average Measured Parallel	Average Measured Perpendicular	Average Predicted Volumetric
1	1.055%	1.422%	6.275%
2	0.883%	1.036%	3.759%
3	0.636%	0.771%	2.145%
4	0.904%	1.054%	3.669%
5	0.872%	1.011%	3.720%
6	1.065%	1.393%	6.444%
7	0.889%	1.015%	3.755%
8	0.673%	0.764%	2.195%
9	0.919%	1.049%	3.766%
10	0.871%	1.015%	3.747%
11	1.065%	1.405%	6.212%
12	0.863%	1.006%	3.703%
13	0.627%	0.747%	2.123%
14	0.897%	1.039%	3.637%
15	0.849%	1.033%	3.684%
16	1.077%	1.361%	8.167%
17	0.951%	1.047%	4.955%
18	0.742%	0.799%	2.947%
19	1.013%	1.063%	4.594%
20	0.922%	1.031%	4.870%
21	0.986%	1.382%	4.863%
22	0.875%	1.122%	3.407%
23	0.751%	0.945%	2.438%
24	0.880%	1.115%	3.425%
25	0.870%	1.141%	3.403%

Residual Stress Coefficients

Corrected residual in-mold stress (CRIMS) model coefficients	
A1	0.657514
A2	-0.110524
A3	0.004268
A4	1.023916
A5	-0.453646
A6	0.004751

Residual Strain Coefficients

Parallel				
	Coefficient	Lower Limit	Upper Limit	Centroid
1	0.078784	0.015684	0.078716	0.039549
2	0.003109	0.080033	0.75694	0.39843
3	-0.000072	6.9275	22.839	13.502
4	1.1505e-007	8873.70	46264.00	23873.00
5	0.002683	0	0	0

Perpendicular				
	Coefficient	Lower Limit	Upper Limit	Centroid
1	0.13422	0.015684	0.078716	0.039549
2	0.003626	0.080033	0.75694	0.39843
3	-9.3533e-006	6.9275	22.839	13.502
4	3.9103e-007	2549.40	6799.00	4339.00
5	0.002307	0	0	0

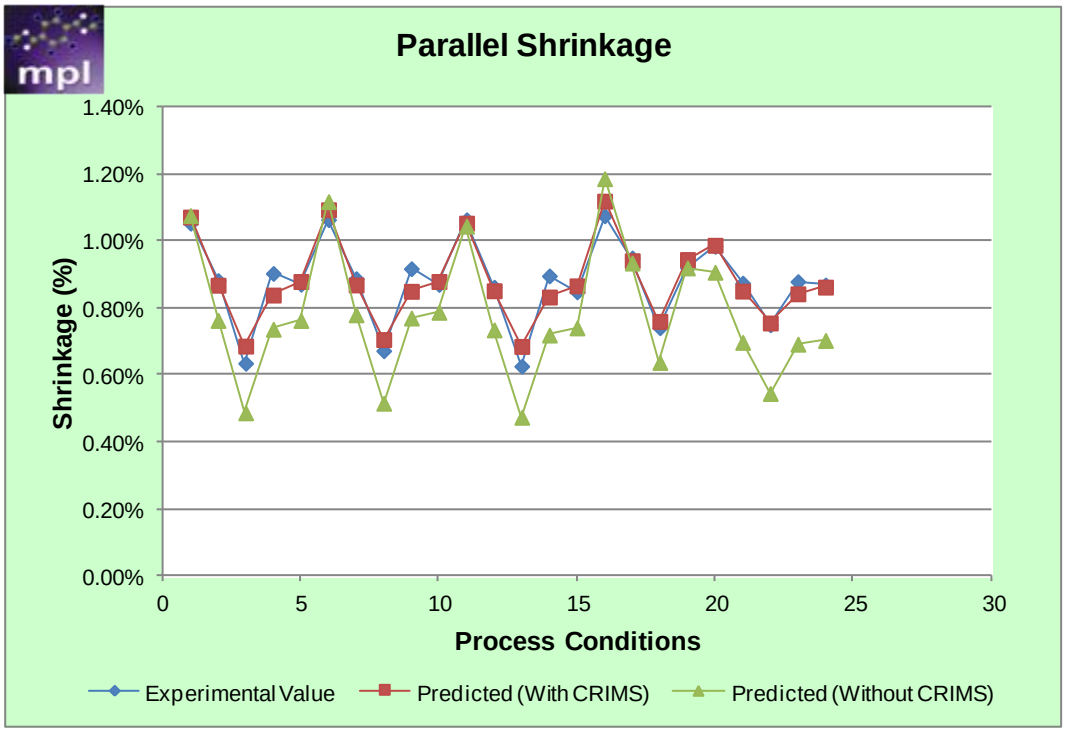
The shrinkage models shown above are valid for Autodesk Moldflow Insight 2012. Shrinkage models for previous software versions are included in the 21000.udb file.

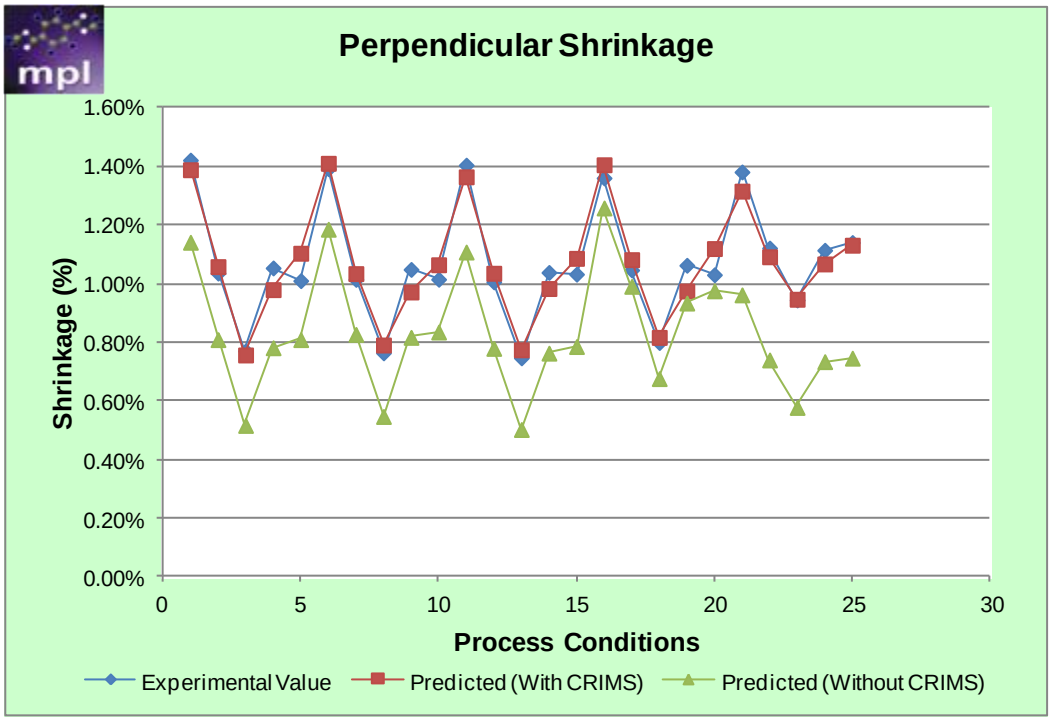
Observed Shrinkage

Observed nominal shrinkage	
Parallel	0.885%
Perpendicular	1.071%

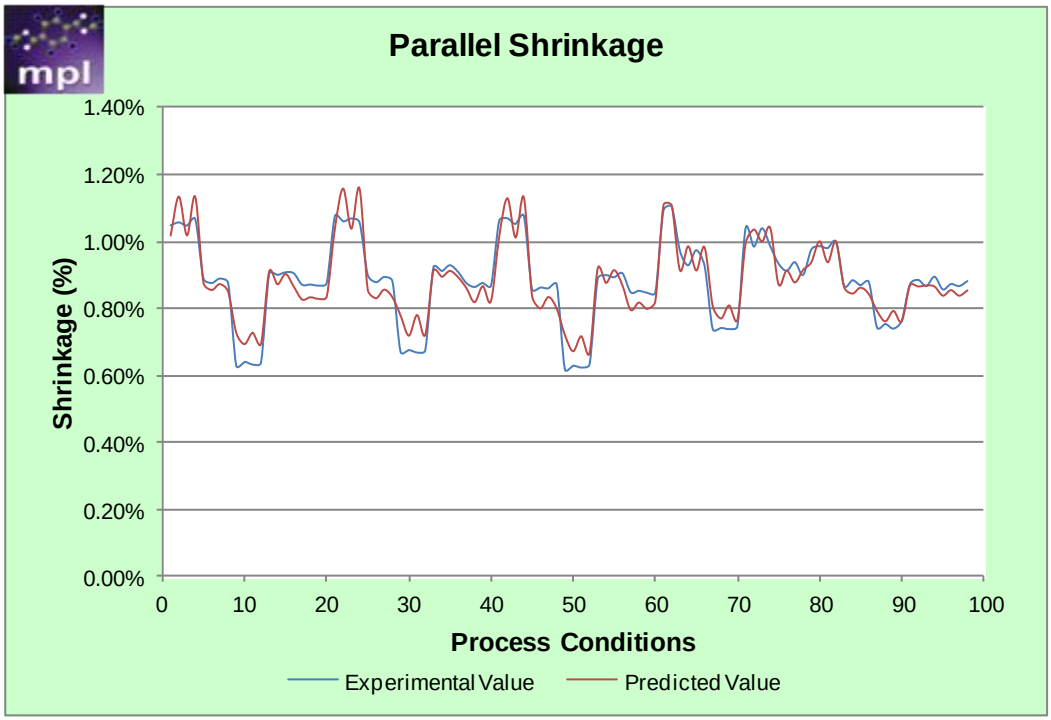
Observed shrinkage	
Minimum Parallel	0.627%
Maximum Parallel	1.077%
Minimum Perpendicular	0.747%
Maximum Perpendicular	1.422%

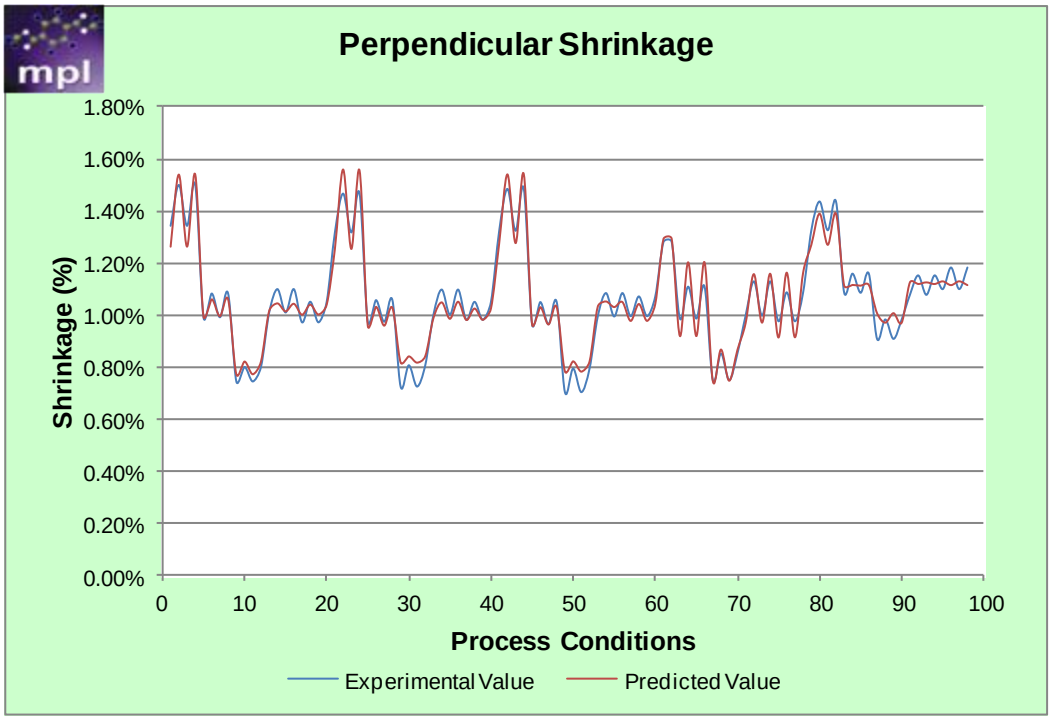
Residual Stress Plots





Residual Strain Plots





Mechanical

Elastic modulus and Poisson's ratio

Method:
ASTM D 638, Standard Test Method for Tensile Properties of Plastics
ASTM E 132, Standard Test Method for Poisson's Ratio at Room Temperature
(Method falls outside the scope of A2LA Accreditation)

Instrument:
MTS Sintech 5/G Universal Testing Machine

Test Specifications:

Specimens Tested:	8
Pre-Processing:	23°C +/-2°C at 50% +/-5% relative humidity for a minimum of 40 hours
Sample Form:	Machined from molded plaques
Test Speed:	5 mm/min
Date Received:	04-NOV-11
Date Tested:	14-FEB-12

Operator's Notes:
Testing was performed per standard testing procedures.
**NOTE: v23 tested slightly higher than expected, assuming isotropic behavior v23 was set equal to v12.

Elastic modulus		
Elastic modulus, 1st principal direction [E1]	2408	MPa
Elastic modulus, 2nd principal direction [E2]	2341	MPa

Poisson's ratio		
Poisson's ratio [v12]	0.3690	
**Poisson's ratio [v23]	0.3690	

Shear modulus

Method:

ASTM D 638, Standard Test Method for Tensile Properties of Plastics
(Method falls outside the scope of A2LA Accreditation)

Instrument:

MTS Sintech 5/G Universal Testing Machine

Test Specifications:

Specimens Tested:	8
Pre-Processing:	23°C +/-2°C at 50% +/-5% relative humidity for a minimum of 40 hours
Sample Form:	Machined from molded plaques
Test Speed:	5 mm/min
Date Received:	04-NOV-11
Date Tested:	14-FEB-12

Operator's Notes:

Shear modulus is calculated using orthotropic elasticity from the tensile modulus measured on a sample cut at an angle of 45° with the flow direction.
Testing was performed per standard testing procedures.
No anomalies were noted during testing.

Shear modulus		
Shear modulus [G12]	792	MPa

Coefficient of linear thermal expansion

Method:
ASTM D 696, Coefficient of Linear Thermal Expansion of Plastics

Instrument:
Quartz tube dilatometer per ASTM

Test Specifications:

Specimens Tested:	2 (per direction): test repeated 2 times per specimen
Pre-Processing:	23°C +/-2°C at 50% +/-5% relative humidity for a minimum of 40 hours
Sample Form:	Machined from molded plaques
Specimen Geometry:	Rectangular, 8mm x 50mm, full thickness
Temperature Range:	0°C to 60°C
Date Received:	04-NOV-11
Date Tested:	14-FEB-12

Operator's Notes:
Testing was performed per standard testing procedures.
No anomalies were noted during testing.

Transversely isotropic coefficient of thermal expansion [CTE] data		
Alpha 1	7.540e-005	1/°C
Alpha 2	7.990e-005	1/°C

ACCREDITED
Testing Cert. 2399.01

Mold verification

Method:
MPL Mold Verification Test Method (QOP-16-M)
(Method falls outside the scope of A2LA Accreditation)

Instrument:
Krauss Maffei KM160-750CX Injection Molding Machine

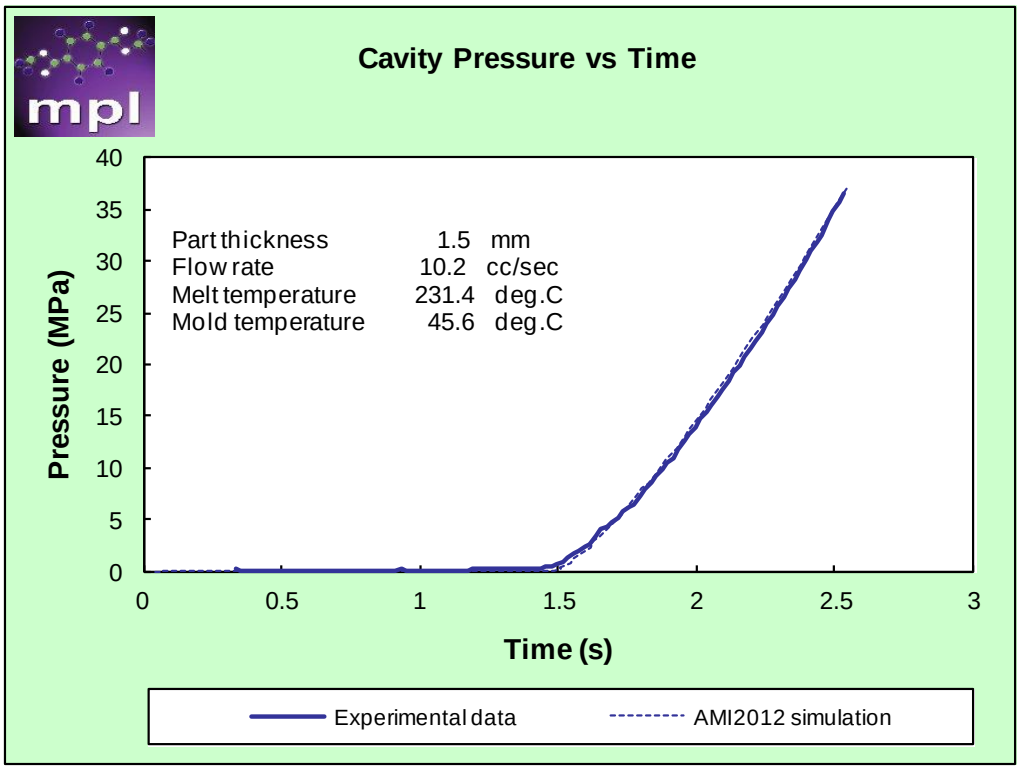
Test Specifications:

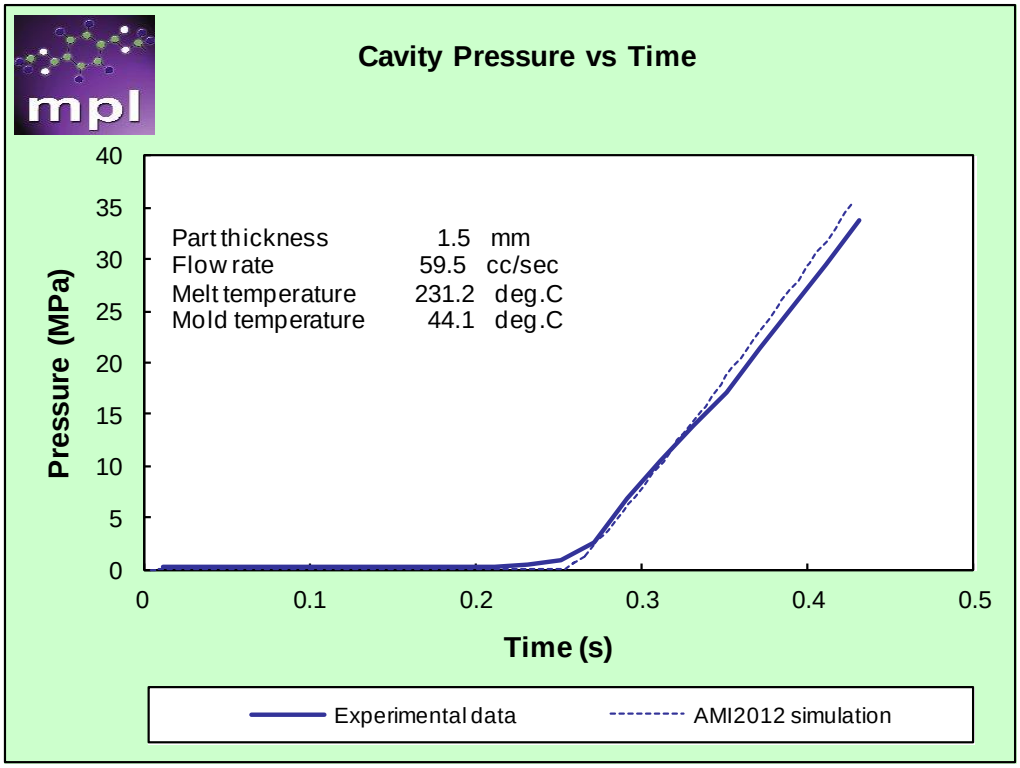
Sample Form:	Pellets
Pre-Processing:	Dried at 85°C for 4 hours in a hopper dryer
Moisture Level:	Not Measured
Date Received:	04-NOV-11
Date Tested:	09-FEB-12

Operator's Notes:
Testing was performed per standard testing procedures.
No anomalies were noted during the course of testing.

1.5mm tag die

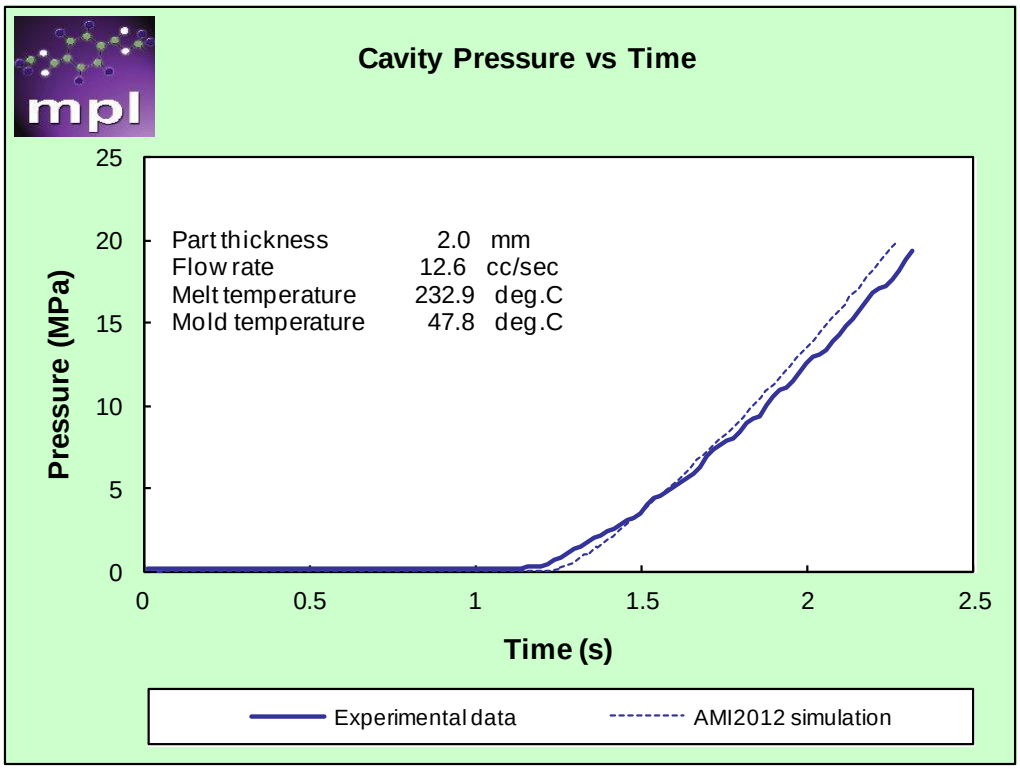
Experiment Number	Flow Rate (cc/sec)	Melt Temperature	Mold Temperature
Cyc0073	10.2	231.4	45.6
Cyc0085	59.5	231.2	44.1

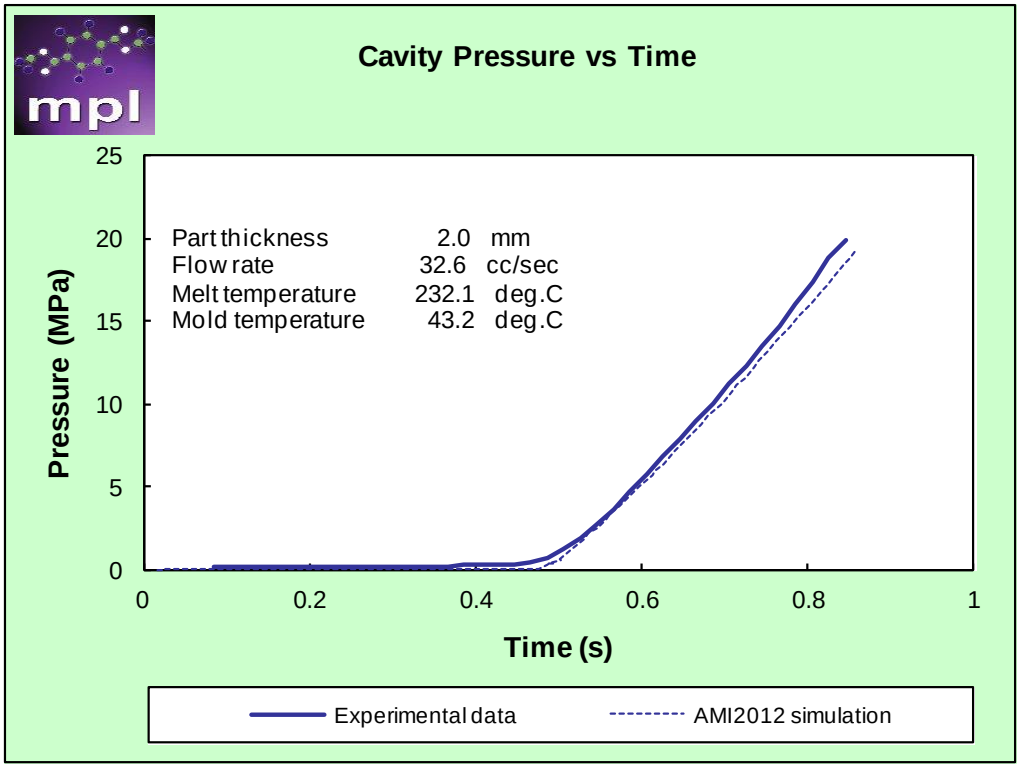




2mm tag die

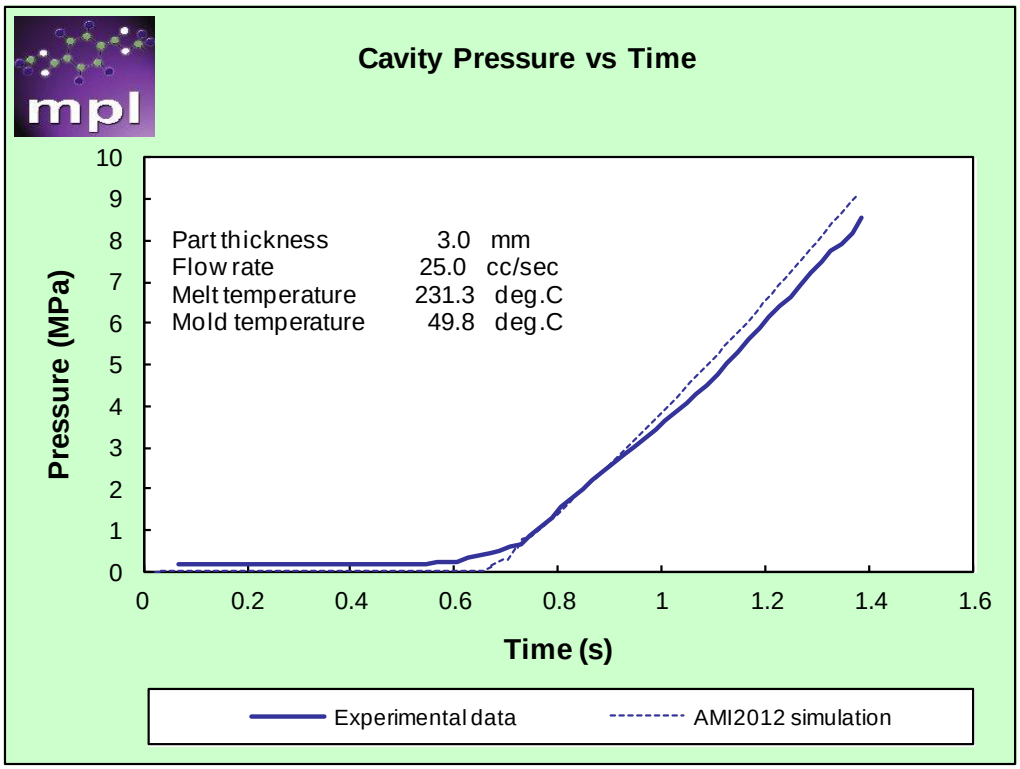
Experiment Number	Flow Rate (cc/sec)	Melt Temperature	Mold Temperature
Cyc0006	12.6	232.9	47.8
Cyc0012	32.6	232.1	43.2

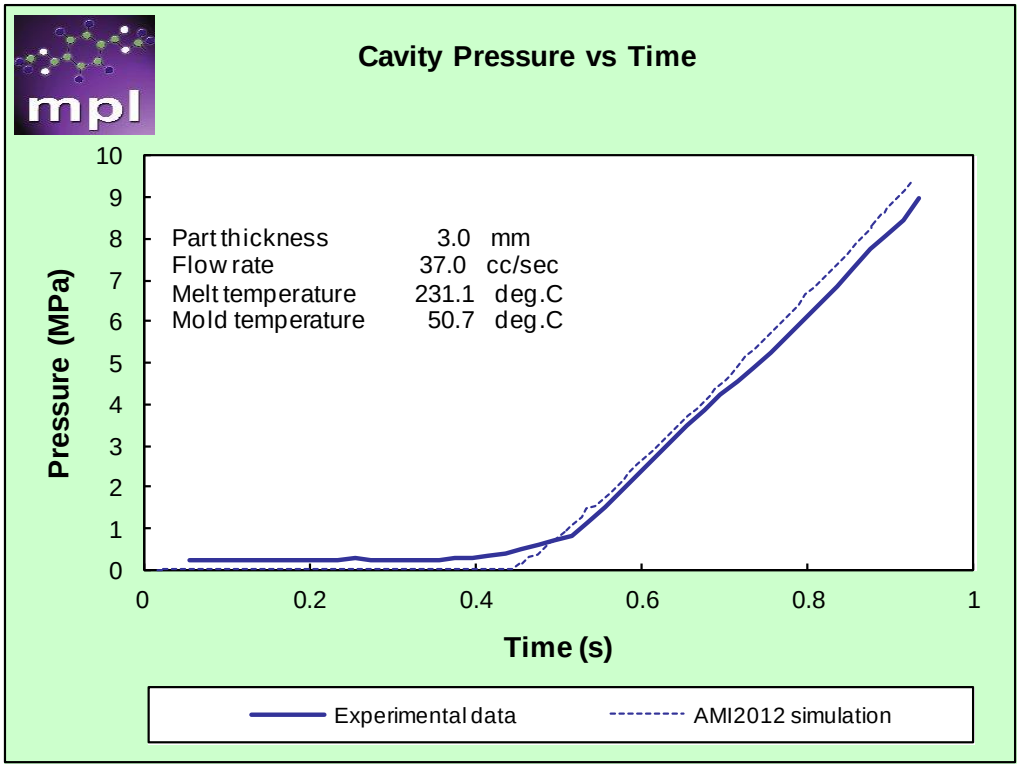




3mm tag die

Experiment Number	Flow Rate (cc/sec)	Melt Temperature	Mold Temperature
Cyc0111	25	231.3	49.8
Cyc0114	37	231.1	50.7





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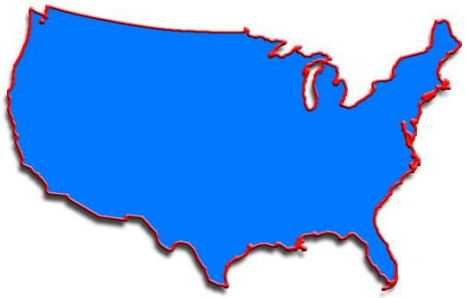

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