

Material Testing Report

SN8089

ISOFIL HK 20 TCH1 NA

Prepared for:

SIRMAX SPA

VIA DELL'ARTIGIANATO 42

CITTADELLA 35013

Italy

Prepared by:

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Prepared on:

22 March, 2017

Report Authorized By:



Stephen Wright

Material Technician

22 March, 2017

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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.

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Summary

Description

Family name	POLYPROPYLENES (PP)
Trade name	ISOFIL HK 20 TCH1 NA
Manufacturer	Sirmax SpA
Family abbreviation	PP
Material structure	Crystalline
Data source	Autodesk Moldflow Plastics Labs : pvT-Measured : mech-Measured
Date last modified	21-MAR-17
Date tested	21-MAR-17
Data status	Non-Confidential
Material ID	32394
Grade code	SN8089
Supplier code	SIRMAX
Fibers/fillers	22% Talc Filled

Recommended Processing

Mold surface temperature	40	°C
Melt temperature	235	°C

Mold temperature range (recommended)		
Minimum	20	°C
Maximum	60	°C

Melt temperature range (recommended)		
Minimum	220	°C
Maximum	250	°C

Absolute maximum melt temperature	290	°C
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Ejection temperature	118	°C
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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	0.31305	
Tau	14304.0	Pa
D1	9.42063e+014	Pa-s
D2	263.15	K
D3	0	K/Pa
A1	31.092	
A2	51.600	K

Juncture loss method coefficients		
C1	2.229e-005	Pa ^(1-c2)
C2	2.103	

Transition temperature		
Ttrans	127	°C

Moldflow Viscosity Index	VI(240)93	
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Melt mass-flow rate (MFR)		
Temperature	230	°C
Load	2.16	Kg
Measured MFR	5.0	g/10min

Thermal Properties

Specific heat data		
Temperature (T) °C	Specific heat (Cp) J/Kg-°C	Heating/Cooling rate °C/s
245	2391.0	-0.33
222	2339.0	-0.33
184	2222.0	-0.33
148	2123.0	-0.33
132	2087.0	-0.33
127	3100.0	-0.33
123	13742.0	-0.33
118	3709.0	-0.33
115	2483.0	-0.33
91	1946.0	-0.33
70	1757.0	-0.33
57	1630.0	-0.33

Thermal conductivity data		
Temperature (T) °C	Thermal conductivity (k) W/m-°C	Heating/Cooling rate °C/s
250	0.175	0.0
221	0.189	0.0
192	0.179	0.0
163	0.188	0.0
133	0.193	0.0
103	0.200	0.0
72	0.190	0.0
51	0.193	0.0
31	0.201	0.0

PVT Properties

Melt density	0.8905	g/cm ³
Solid density	1.0959	g/cm ³

2-domain Tait PVT model coefficients

b5	434.15	K
b6	8.451e-008	K/Pa
b1m	0.001063	m ³ /Kg
b2m	8.095e-007	m ³ /Kg-K
b3m	8.65223e+007	Pa
b4m	0.005642	1/K
b1s	0.000974	m ³ /Kg
b2s	4.508e-007	m ³ /Kg-K
b3s	1.59679e+008	Pa
b4s	0.004951	1/K
b7	0.000089	m ³ /Kg
b8	0.10215	1/K
b9	1.331e-008	1/Pa

Mechanical Properties

Mechanical properties data

Elastic modulus, 1 st principal direction [E1]	2788	MPa
Elastic modulus, 2 nd principal direction [E2]	2647	MPa
Poisson's ratio [v12]	0.3580	
Poisson's ratio [v23]	0.3580	
Shear modulus [G12]	946	MPa

Transversely isotropic coefficient of thermal expansion [CTE] data

Alpha1	6.340e-005	1/°C
Alpha2	6.690e-005	1/°C

Shrinkage Properties

Corrected residual in-mold stress (CRIMS) model coefficients	
A1	0.49804
A2	0.098987
A3	0.004715
A4	0.872242
A5	-0.341321
A6	0.005095

Residual strain model coefficients		
	Parallel	Perpendicular
A1	0.061067	0.1124
A2	0.00062	0.000974
A3	-0.00023	-0.000085
A4	1.5012e-007	4.382e-007
A5	0.004962	0.003222

**The shrinkage models shown above are valid for Autodesk Simulation Moldflow Insight 2017.
Shrinkage models for previous software versions are included in the 21000.udb file.**

Filler Properties

Filler data	
Description	Weight %
Talc	22

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 70°C for 1 hours in a hopper dryer
Moisture Level:	0.0146 %
Capillary A: Length:	32.3889 mm
L/D:	16.19445
Die Entry Angle:	90 degrees
Capillary B: Length:	8.0249 mm
L/D:	4.01245
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:	18-JAN-17
Date Tested:	24-FEB-17

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
200.7	192	488.67	2	16.19
200.7	767	190.28	2	16.19
200.8	311	351.76	2	16.19
201.4	2595	83.54	2	16.19
201.8	1349	129.14	2	16.19
202.5	6478	47.36	2	16.19
202.7	12793	33.02	2	16.19
217.8	193	410.91	2	16.19
219.7	311	295.64	2	16.19
220.3	767	160.61	2	16.19
220.8	1346	109.43	2	16.19
221.6	2599	70.18	2	16.19
221.7	6493	38.86	2	16.19
221.8	25629	17.49	2	16.19
222.1	12792	25.51	2	16.19
240.7	311	255.64	2	16.19
240.8	191	354.8	2	16.19
241.7	1350	95.53	2	16.19
241.7	2595	61.72	2	16.19
241.7	25660	14.37	2	16.19
241.8	766	140.28	2	16.19
241.8	6493	33.78	2	16.19
242.6	12782	21.89	2	16.19
260.8	192	314.55	2	16.19
261.3	311	227.96	2	16.19
261.7	767	124.43	2	16.19
261.7	64825	7.34	2	16.19
261.8	1348	84.78	2	16.19
261.8	6485	29.94	2	16.19
262.2	2593	54.54	2	16.19
262.8	12766	19.32	2	16.19
263.6	25590	12.45	2	16.19
200.8	311	429.02	2	4.01
200.9	767	260.96	2	4.01
201.3	192	562.8	2	4.01
201.8	1349	192.32	2	4.01
202.4	2595	135.75	2	4.01
204.9	6478	84.46	2	4.01
206.5	12793	59.47	2	4.01
220	311	332.96	2	4.01
221	767	206.67	2	4.01
221.3	193	426.97	2	4.01
221.7	1346	153.01	2	4.01
222.7	12792	47.41	2	4.01
223	2599	107.45	2	4.01
223	25629	33.41	2	4.01
224	6493	66.8	2	4.01
242	191	384.94	2	4.01
242	766	182.02	2	4.01
242.2	311	297.21	2	4.01
242.7	1350	132.82	2	4.01

Temperature (°C)	Apparent Shear Rate (sec ⁻¹)	Apparent Viscosity (Pa-s)	Die Diameter (mm)	Die L/D
242.9	2595	92.63	2	4.01
242.9	25660	28.23	2	4.01
243.6	12782	40.17	2	4.01
244	6493	56.81	2	4.01
263	192	320.72	2	4.01
263	311	250.14	2	4.01
263	767	154.16	2	4.01
263.5	1348	113.14	2	4.01
264	2593	78.44	2	4.01
264	6485	47.93	2	4.01
264	25590	23.85	2	4.01
265	64825	14.81	2	4.01
265.1	12766	33.92	2	4.01

Calculated Viscosity Data

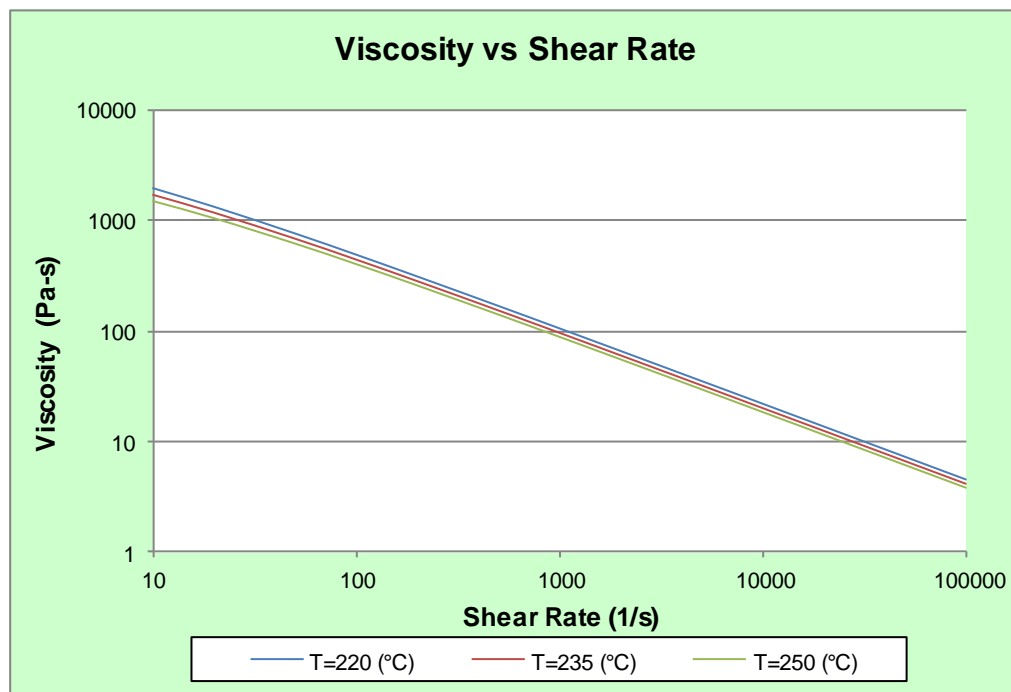
Temperature (°C)	Shear Rate (sec ⁻¹)	Calculated Viscosity (Pa-s)
200.7	192	368.17
200.7	767	144.62
200.8	311	266.2
200.8	311	266.2
200.9	767	144.41
201.3	192	366.47
201.4	2595	62.67
201.8	1349	97.67
201.8	1349	97.67
202.4	2595	62.21
202.5	6478	33.23
202.7	12793	20.81
204.9	6478	32.67
206.5	12793	20.26
217.8	193	323.72
219.7	311	232.57
220	311	232.1
220.3	767	126.13
220.8	1346	85.83
221	767	125.56
221.3	193	316.05
221.6	2599	54.54
221.7	1346	85.34
221.7	6493	29.15
221.8	25629	11.37
222.1	12792	18.27
222.7	12792	18.2
223	2599	54.06
223	25629	11.28
224	6493	28.73
240.7	311	203.77
240.8	191	280.84
241.7	25660	10.11
241.7	1350	75.55
241.7	2595	48.45
241.8	766	110.76
241.8	6493	25.89
242	766	110.64
242	191	278.81
242.2	311	201.98
242.6	12782	16.21
242.7	1350	75.13
242.9	25660	10.04
242.9	2595	48.13
243.6	12782	16.13
244	6493	25.58
260.8	192	249.51
261.3	311	181.65
261.7	64825	4.83
261.7	767	99.47
261.8	1348	68.01

Temperature (°C)	Shear Rate (sec ⁻¹)	Calculated Viscosity (Pa-s)
261.8	6485	23.36
262.2	2593	43.56
262.8	12766	14.63
263	767	98.82
263	192	246.55
263	311	180.04
263.5	1348	67.44
263.6	25590	9.05
264	25590	9.03
264	6485	23.12
264	2593	43.18
265	64825	4.75
265.1	12766	14.47

Rheological Data

Cross WLF Viscosity Model		
n	0.31305	
Tau	14304.0	Pa
D1	9.42063e+014	Pa-s
D2	263.15	K
D3	0	K/Pa
A1	31.092	
A2	51.600	K

Juncture loss method coefficients		
C1	2.229e-005	Pa ^(1-c2)
C2	2.103	



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

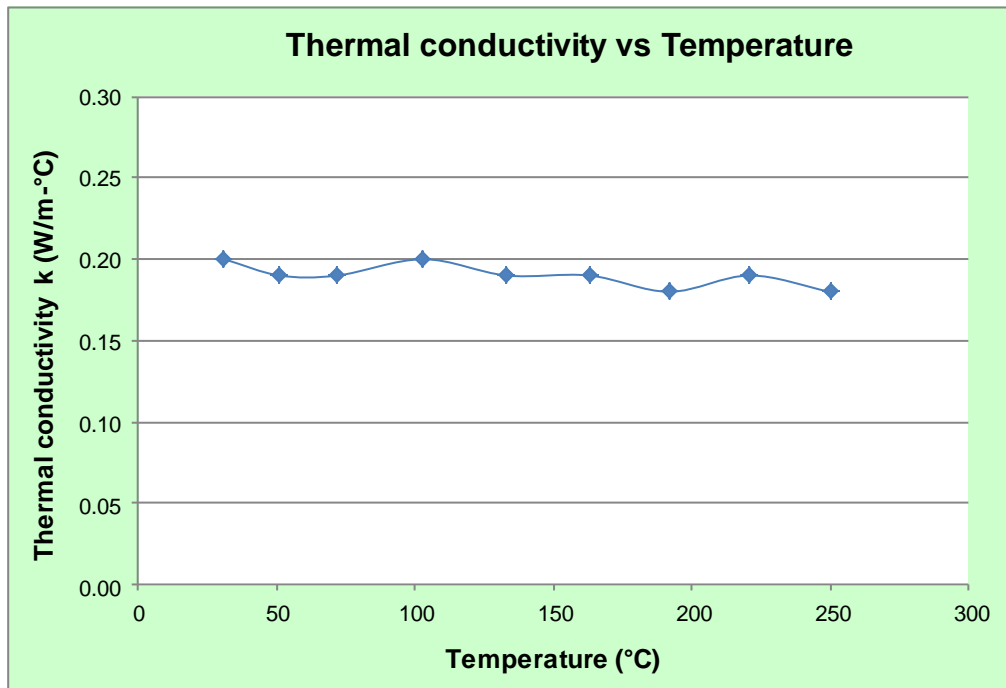
Test Specifications:

Sample Form:	Pellets
Pre-Processing:	Dried at 70°C for 1 hours in a hopper dryer
Moisture Level:	Not measured
Probe Constant:	0.78
Probe Length:	50 mm
Data acquisition time:	45 sec
Probe Voltage:	2.5 V
Date Received:	18-JAN-17
Date Tested:	21-MAR-17

Operator's Notes:

Testing was performed at an external A2LA accredited laboratory 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
250	0.175	0.0
221	0.189	0.0
192	0.179	0.0
163	0.188	0.0
133	0.193	0.0
103	0.200	0.0
72	0.190	0.0
51	0.193	0.0
31	0.201	0.0



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:

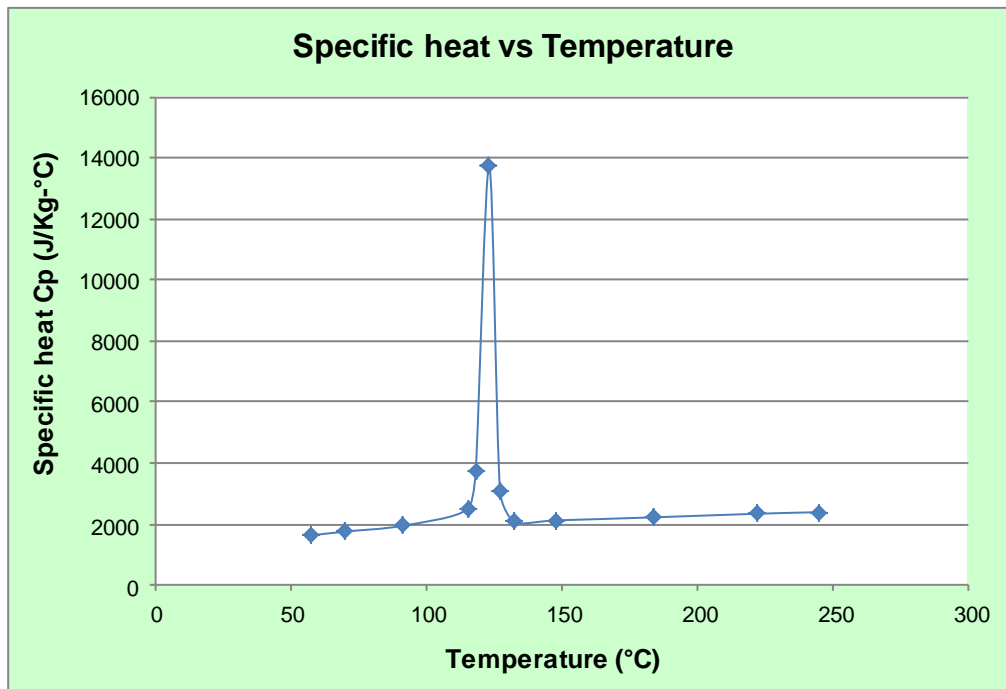
Sample Form:	Pellets
Pre-Processing:	Dried at 70°C for 1 hours in a hopper dryer
Moisture Level:	0.0146 %
Initial Temperature:	250°C
Final Temperature:	40°C
Cooling Rate:	20°C/min
Equilibrium Time:	3 min
Sample holder material:	Aluminum
Sample holder dimensions:	6.7 mm diameter, 1.6 mm tall
Sample holder mass:	25 mg (pan + lid)
Purge gas:	99.99% pure nitrogen
Purge gas flow rate:	30 cm ³ /sec
Date Received:	18-JAN-17
Date Tested:	24-FEB-17

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
245	2391.0	-0.33
222	2339.0	-0.33
184	2222.0	-0.33
148	2123.0	-0.33
132	2087.0	-0.33
127	3100.0	-0.33
123	13742.0	-0.33
118	3709.0	-0.33
115	2483.0	-0.33
91	1946.0	-0.33
70	1757.0	-0.33
57	1630.0	-0.33

T _{trans}	127	°C
Ejection temperature	118	°C



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:	18-JAN-17
Date Tested:	13-MAR-17

Operator's Notes:

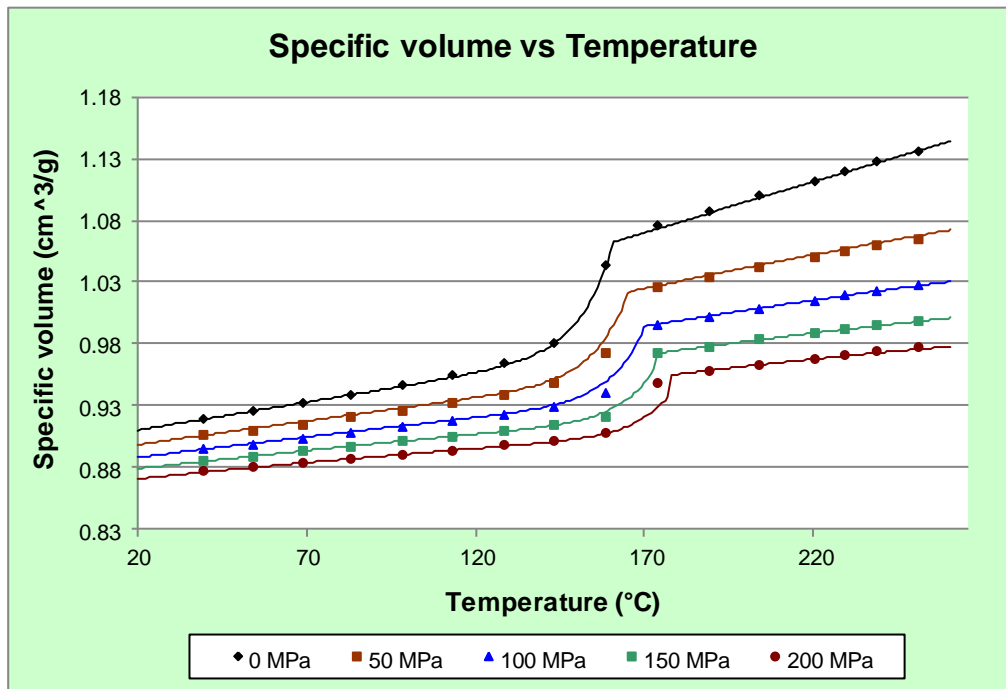
Testing was performed per standard testing procedures.
No anomalies were noted during the course of testing.

pvT Experimental Data

Temperature (°C)	Pressure (MPa)				
	0MPa	50MPa	100MPa	150MPa	200MPa
39.33	0.9196	0.9060	0.8950	0.8862	0.8781
53.89	0.9252	0.9103	0.8990	0.8894	0.8805
68.68	0.9317	0.9152	0.9030	0.8929	0.8836
83.21	0.9388	0.9206	0.9076	0.8972	0.8875
98.35	0.9465	0.9264	0.9124	0.9010	0.8909
112.9	0.9549	0.9322	0.9171	0.9050	0.8943
128.2	0.9648	0.9395	0.9225	0.9093	0.8979
143.3	0.9801	0.9487	0.9291	0.9141	0.9021
158.4	1.0440	0.9732	0.9396	0.9216	0.9078
174	1.0760	1.0260	0.9947	0.9720	0.9488
189.4	1.0880	1.0340	1.0010	0.9777	0.9580
204.3	1.1000	1.0420	1.0080	0.9838	0.9634
220.3	1.1110	1.0500	1.0140	0.9886	0.9674
229.7	1.1190	1.0550	1.0190	0.9927	0.9715
239.1	1.1270	1.0600	1.0230	0.9960	0.9744
251.1	1.1360	1.0650	1.0270	0.9989	0.9768

Melt density	0.8905	g/cm ³
Solid density	1.0959	g/cm ³

2-domain Tait PVT model coefficients		
b5	434.15	K
b6	8.451e-008	K/Pa
b1m	0.001063	m ³ /Kg
b2m	8.095e-007	m ³ /Kg-K
b3m	8.65223e+007	Pa
b4m	0.005642	1/K
b1s	0.000974	m ³ /Kg
b2s	4.508e-007	m ³ /Kg-K
b3s	1.59679e+008	Pa
b4s	0.004951	1/K
b7	0.000089	m ³ /Kg
b8	0.10215	1/K
b9	1.331e-008	1/Pa



Shrinkage

Method:

AMPL 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 70°C for 1 hours in a hopper dryer
Moisture Level:	0.0146 %
Date Molded:	24-FEB-17
Post-Processing:	Conditioned at 23°C / 50% relative humidity for 7 days
Date Measured:	03-MAR-17
Shrinkage Data Correlated With:	Autodesk Simulation Moldflow Insight 2017
Default Model:	Residual Stress (CRIMS)
Date Received:	18-JAN-17

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	234.3	39.0	37.4	2	24.4	12	10
2	234.5	42.5	39.7	2	43.6	12	10
3	234.4	43.4	37.4	2	62.8	12	10
4	234.3	39.5	17.2	2	43.8	12	10
5	234.3	44.2	57.7	2	43.8	12	10
6	219.3	38.7	39.7	2	24.4	11	10
7	219.1	43.4	39.7	2	43.6	11	10
8	219.0	40.6	37.4	2	63.0	11	10
9	218.9	41.2	19.0	2	43.4	11	10
10	219.3	44.0	60.5	2	43.8	11	10
11	250.0	43.8	39.7	2	24.5	13	10
12	250.2	39.3	37.4	2	43.5	13	10
13	250.2	42.7	37.4	2	63.0	13	10
14	250.2	43.8	19.0	2	43.6	13	10
15	250.2	38.9	57.7	2	43.8	13	10
16	234.6	39.2	32.8	1.5	34.2	8	10
17	234.5	39.0	32.8	1.5	53.6	8	10
18	234.5	43.4	31.7	1.5	73.2	8	10
19	234.5	39.1	14.9	1.5	53.5	8	10
20	234.5	40.6	50.1	1.5	53.8	8	10
21	234.4	38.5	46.9	3	14.8	23	10
22	234.3	43.6	46.9	3	29.3	23	10
23	234.2	38.8	40.0	3	43.9	23	10
24	234.2	43.7	24.3	3	29.6	23	10
25	234.1	39.2	64.8	3	29.4	23	10

Part Shrinkage

Process Condition	Average Measured Parallel	Average Measured Perpendicular	Average Predicted Volumetric
1	1.081%	1.320%	6.429%
2	0.992%	1.091%	4.420%
3	0.865%	0.912%	3.258%
4	1.027%	1.111%	4.345%
5	0.956%	1.066%	4.429%
6	1.152%	1.333%	6.626%
7	1.089%	1.117%	4.526%
8	0.963%	0.933%	3.312%
9	1.117%	1.129%	4.509%
10	1.059%	1.103%	4.518%
11	1.054%	1.312%	6.270%
12	0.938%	1.046%	4.334%
13	0.795%	0.902%	3.170%
14	0.964%	1.089%	4.258%
15	0.887%	1.036%	4.335%
16	1.097%	1.178%	6.873%
17	1.017%	0.994%	4.982%
18	0.906%	0.807%	3.627%
19	1.101%	1.041%	4.804%
20	0.994%	0.976%	4.999%
21	1.029%	1.426%	6.648%
22	0.965%	1.200%	4.345%
23	0.863%	1.011%	3.477%
24	0.967%	1.222%	4.343%
25	0.933%	1.185%	4.326%

Residual Stress Coefficients

Corrected residual in-mold stress (CRIMS) model coefficients	
A1	0.49804
A2	0.098987
A3	0.004715
A4	0.872242
A5	-0.341321
A6	0.005095

Residual Strain Coefficients

Parallel				
	Coefficient	Lower Limit	Upper Limit	Centroid
1	0.061067	0.02494	0.086145	0.046792
2	0.00062	0.18589	0.75154	0.43305
3	-0.00023	2.7066	17.877	9.9525
4	1.5012e-007	9957.10	49854.00	27239.00
5	0.004962	0	0	0

Perpendicular				
	Coefficient	Lower Limit	Upper Limit	Centroid
1	0.1124	0.02494	0.086145	0.046866
2	0.000974	0.18589	0.75154	0.43307
3	-0.000085	2.7066	17.877	10.024
4	4.382e-007	3905.90	11362.00	6749.40
5	0.003222	0	0	0

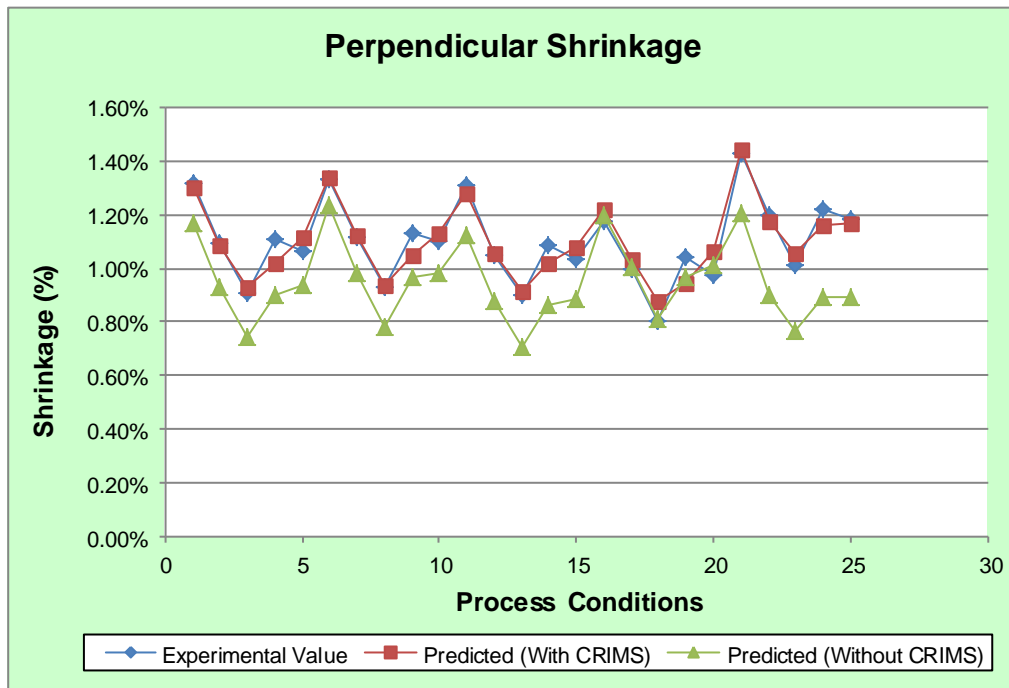
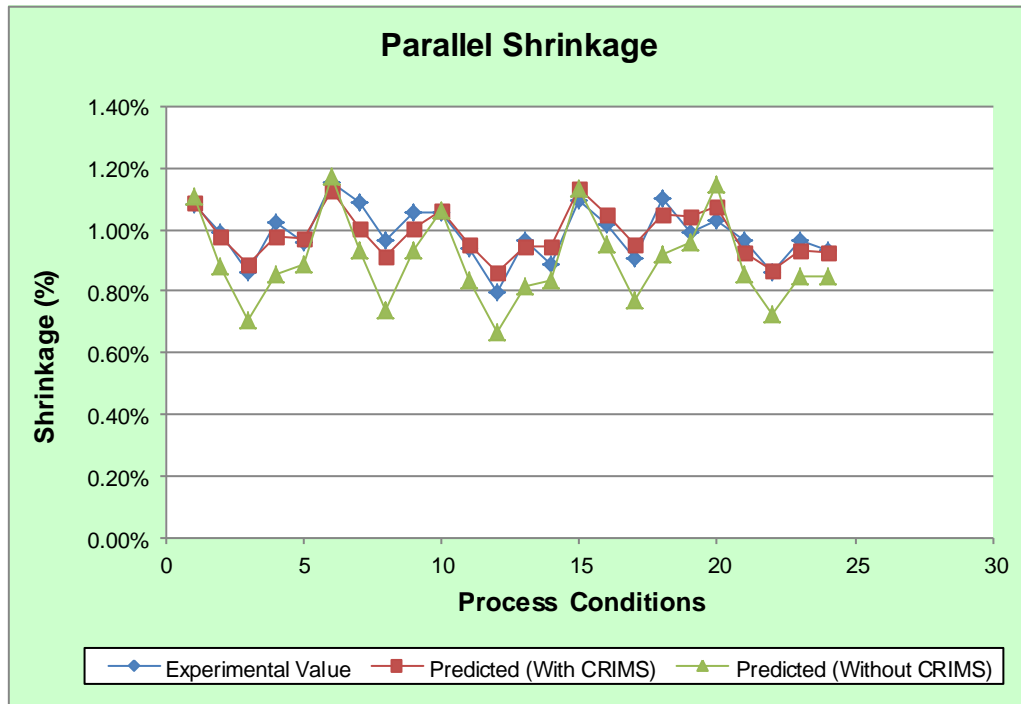
**The shrinkage models shown above are valid for Autodesk Simulation Moldflow Insight 2017.
Shrinkage models for previous software versions are included in the .21000.udb file.**

Observed Shrinkage

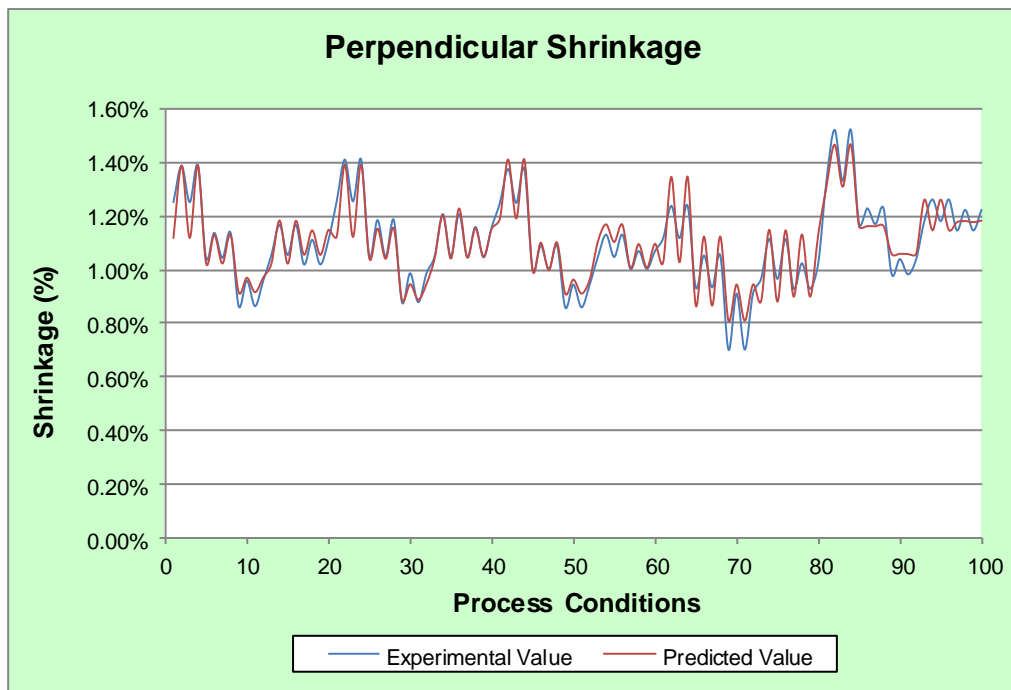
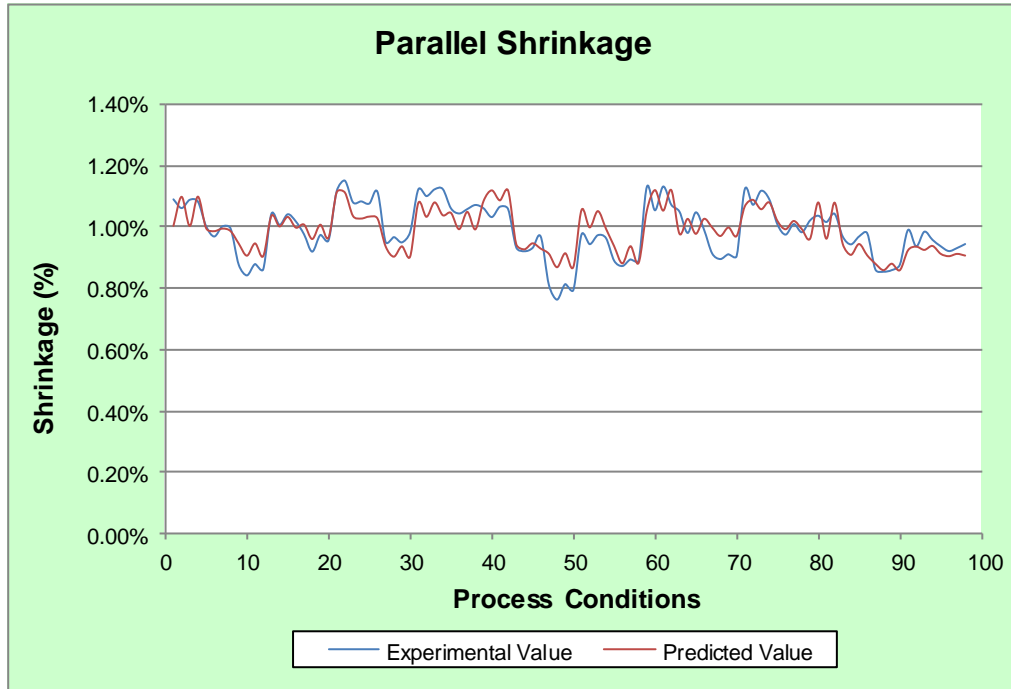
Observed nominal shrinkage	
Parallel	0.993%
Perpendicular	1.102%

Observed shrinkage	
Minimum Parallel	0.795%
Maximum Parallel	1.152%
Minimum Perpendicular	0.807%
Maximum Perpendicular	1.426%

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

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:	18-JAN-17
Date Tested:	01-MAR-17

Operator's Notes:

Testing was performed per standard testing procedures.

**NOTE: measured values for v23 were higher than expected; based on other data v23 was set equal to v12.

Elastic modulus		
Elastic modulus, 1 st principal direction [E1]	2788	MPa
Elastic modulus, 2 nd principal direction [E2]	2647	MPa

Poisson's ratio		
Poisson's ratio [v12]	0.3580	
Poisson's ratio [v23]	0.3580	



Shear modulus

Method:

ASTM D 638, Standard Test Method for Tensile Properties of Plastics

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:	18-JAN-17
Date Tested:	01-MAR-17

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]	946	MPa



Coefficient of linear thermal expansion

Method:

QOP-11, 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:	18-JAN-17
Date Tested:	01-MAR-17

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	6.340e-005	1/°C
Alpha 2	6.690e-005	1/°C



Mold verification

Method:

AMPL 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:

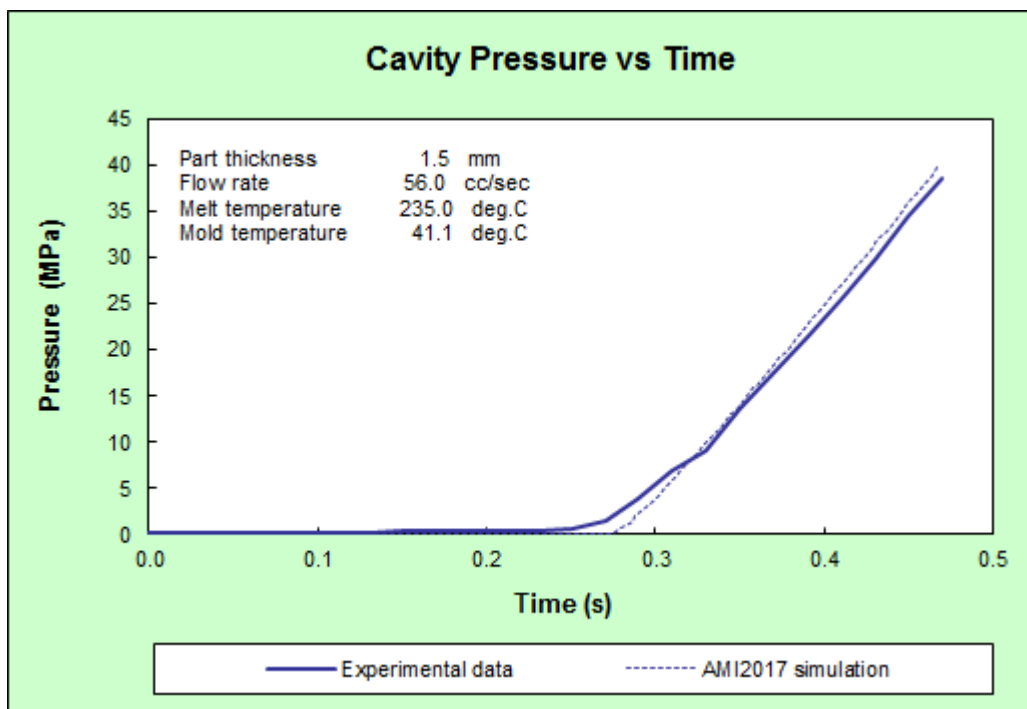
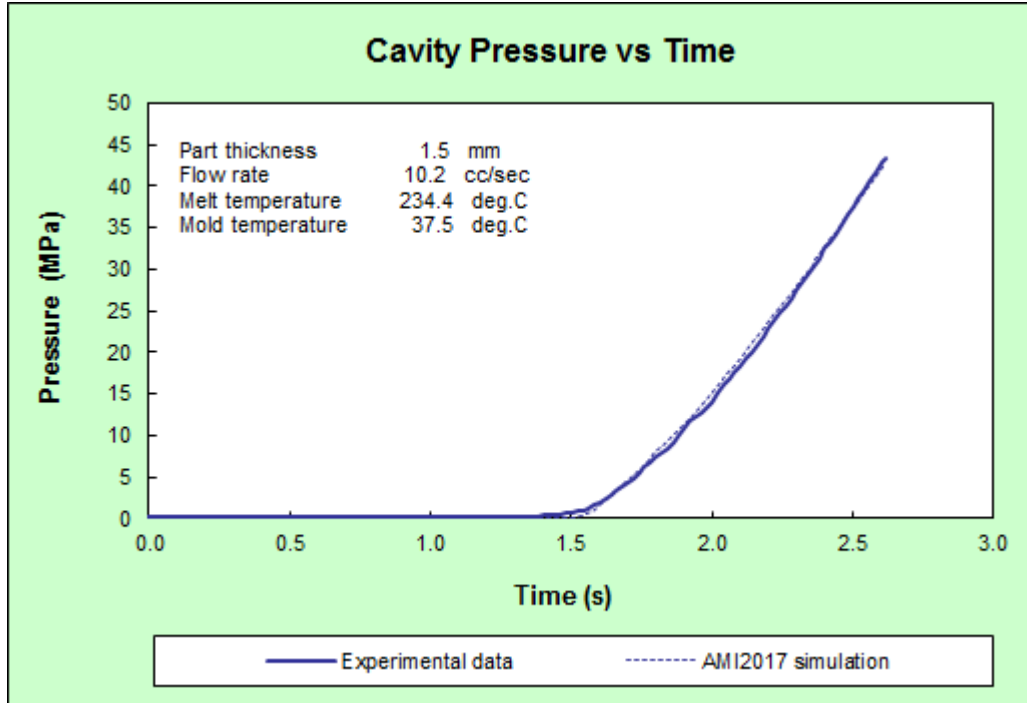
Sample Form:	Pellets
Pre-Processing:	Dried at 70°C for 1 hours in a hopper dryer
Moisture Level:	0.0146 %
Date Received:	18-JAN-17
Date Tested:	24-FEB-17

Operator's Notes:

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

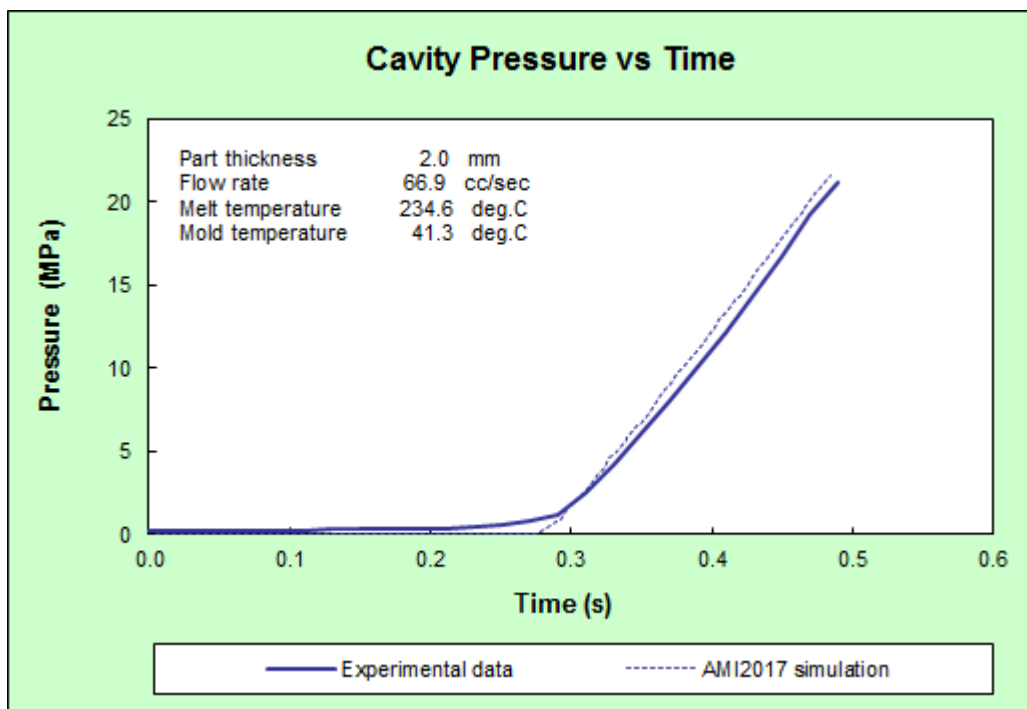
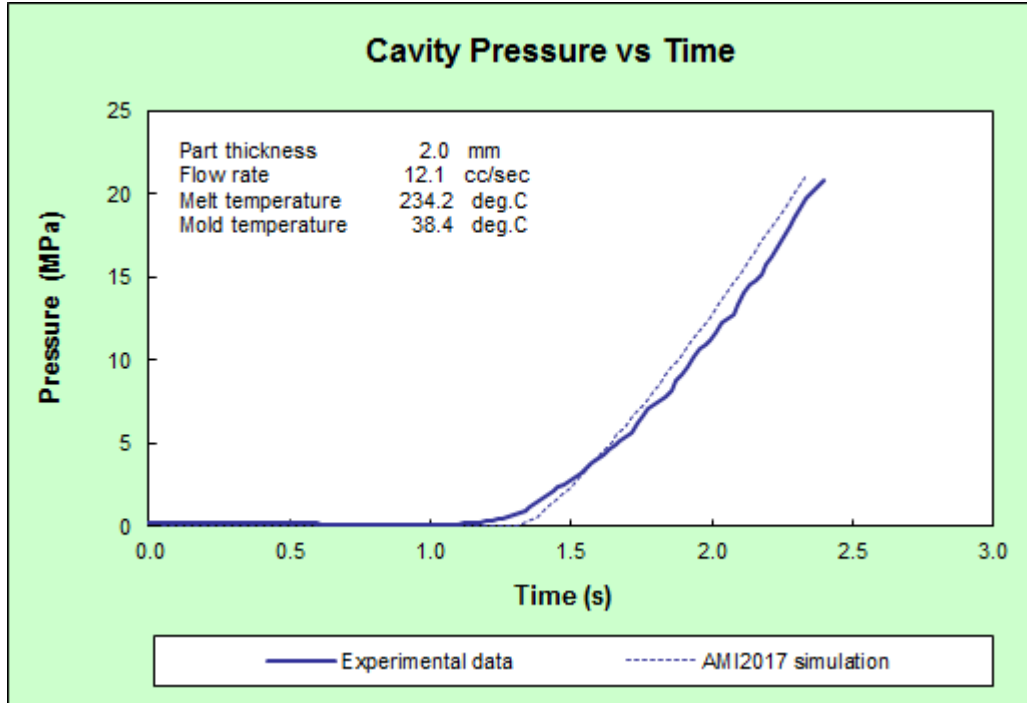
1.5mm tag die

Experiment Number	Flow Rate (cc/sec)	Melt Temperature	Mold Temperature
Cyc0118	10.2	234.4	37.5
Cyc0130	56	235	41.1



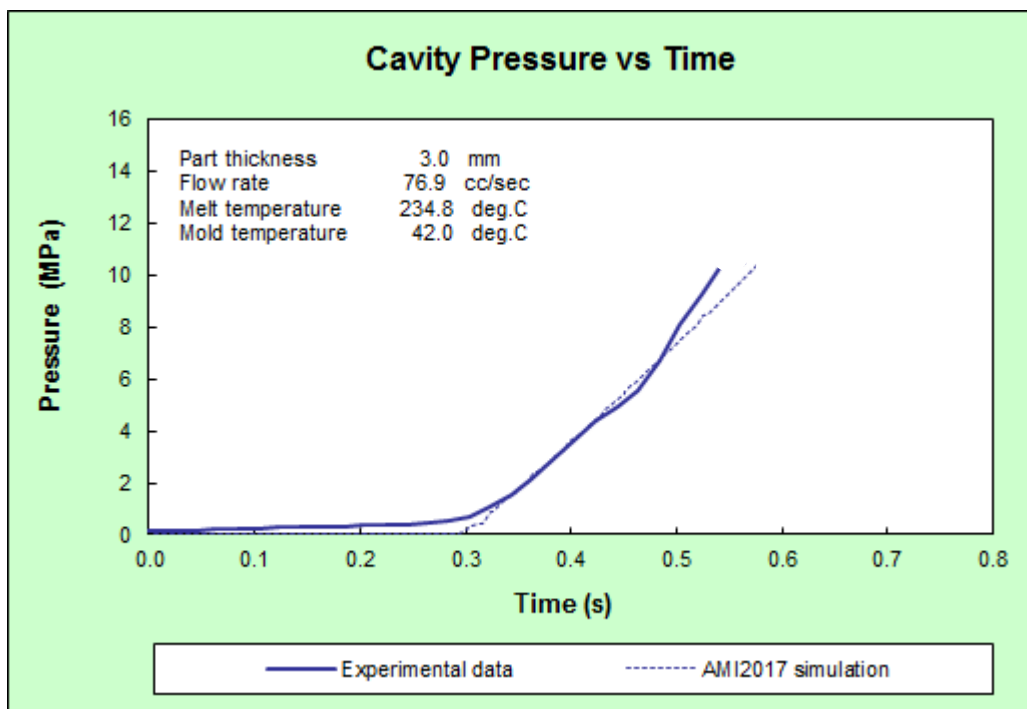
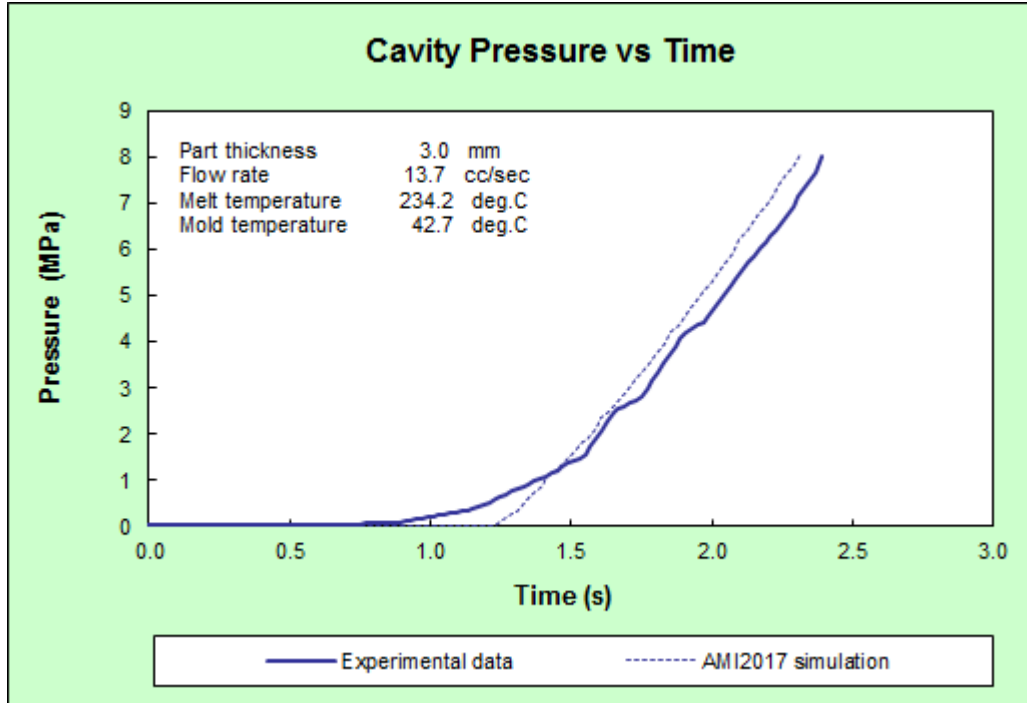
2mm tag die

Experiment Number	Flow Rate (cc/sec)	Melt Temperature	Mold Temperature
Cyc0010	12.1	234.2	38.4
Cyc0022	66.9	234.6	41.3



3mm tag die

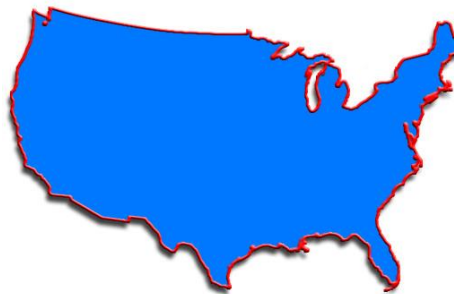
Experiment Number	Flow Rate (cc/sec)	Melt Temperature	Mold Temperature
Cyc0171	13.7	234.2	42.7
Cyc0183	76.9	234.8	42



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