Audia TPE 360

Testing Cert # 1242.01

Test Report

Audia TPE 360

Client	Brent Wang
Company	Audia Elastomers
Address	Washington, PA, 15301 United States
Sample Received	10/18/2019
Sample Source	Audia Elastomers
Report Prepared	10/28/2019
Prepared By	
Title	Engineer
Issued By	
Title	Operations Manager

DatapointLabs

http://www.datapointlabs.com

95 Brown Road, Ithaca, NY 14850

Phone: 607-266-0405 Fax: 607-266-0168

Toll-Free (U.S.): 1-888-328-2422

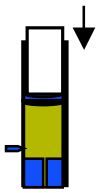
This data is available in True Digital format

dds matereality

www.matereality.com

Table of Contents

Viscosity



Method	ASTM D3835-16 Determination of Properties of Polymeric Materials by Means of a Capillary Rheometer		
Instrument	Goettfert Rheograph 2003 Capillary Rheometer		
Specimen	form	pellets	
	drying	3hrs / 80°C / Vac	
	other preparation	none	
Parameters	initial pressure	0	MPa
	barrel diameter	12	mm
	die entry angle	180	°
	die diameter	1	mm
	die length	20	mm
	preheat time	6	min
Data Correction	Rabinowitsch		
Precision	temperature	+/- 0.1	°C
	die inner diameter	+/- 0.0069	mm
	die length	+/- 0.025	mm
Uncertainty	per standard		

Technique Notes:

Polymer rheology characterizes the complex flow behavior of plastics. A capillary rheometer measures viscosity as a function of temperature and shear rate. The Goettfert rheometer utilizes direct measurement of melt pressures through a side mounted pressure transducer.

Data are modeled using empirical or semi-empirical equations.

Testing Notes:

Viscosity Data

220 °C		*240 °C*		*260 °C*	
Shear Rate s^{-1}	**Viscosity Pa·s**	**Shear Rate s^{-1}**	**Viscosity Pa·s**	**Shear Rate s^{-1}**	**Viscosity Pa·s**
11.6	872.34	22.4	354.09	53.1	172.43
28.7	436.31	58.9	227.90	118.9	123.27
63.7	301.82	125.2	163.34	259.2	83.63
132.5	205.03	270.5	106.10	644.0	53.57
285.9	129.20	667.9	66.28	1368.4	34.58
695.7	78.12	1466.6	40.18	3056.4	20.68
1487.3	47.63	3232.4	23.24	7514.8	11.70
3316	27.26	7738	13.22	15266	7.20
8115	14.86	15685	8.06		
16687	8.73				

Tested By: *JA*
Certified By: *SW*
Test Date: *10/24/2019*

Viscosity Continued

Cross/WLF Model (C-MOLD, Moldflow)

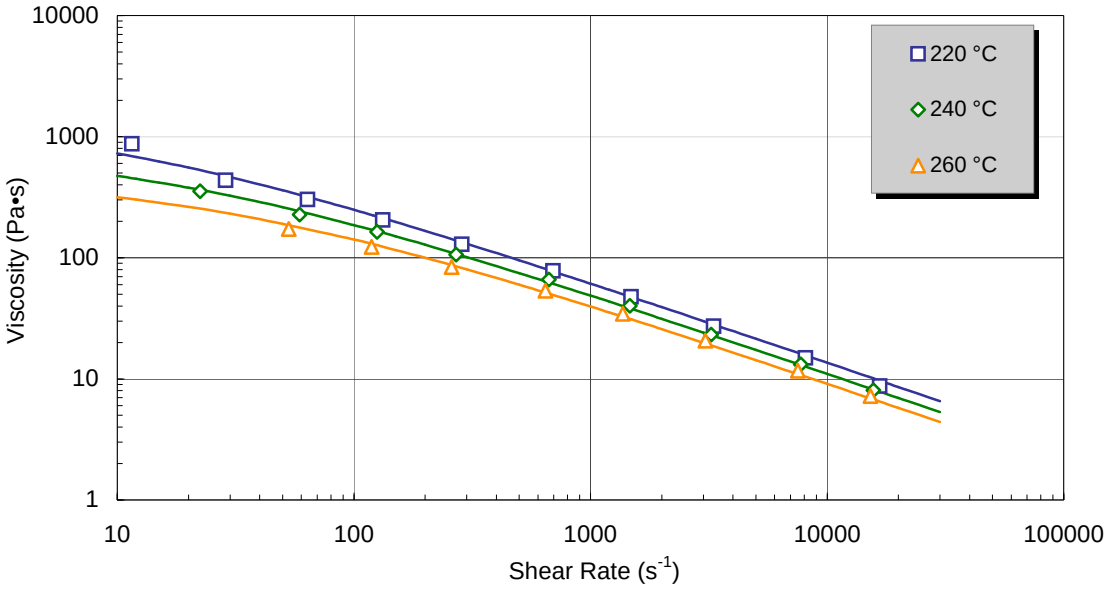
$$\eta(T,\dot{\gamma}) = \frac{\eta_0(T)}{1+\left(\frac{\eta_0\dot{\gamma}}{\tau^*}\right)^{1-n}}, where$$

$$\eta_0(T) = D_1 \exp\left[-\frac{A_1(T-D_2)}{A_2+(T-D_2)}\right]$$

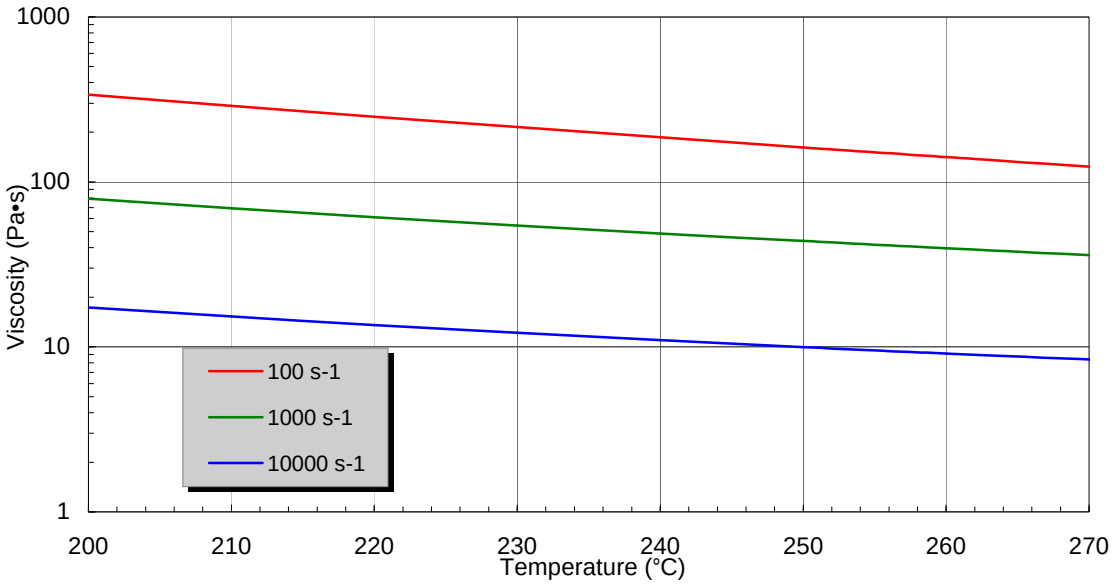
Coefficients (SI units)

n	0.33240
t*	13078.8
D1	1.12E+20
D2	273.15
A1	47.94
A2	51.6

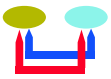
Viscosity vs Shear Rate



Viscosity vs Temperature



Specific Heat



Method	ASTM E1269-11 Determining Specific Heat Capacity by Differential Scanning Calorimetry		
Instrument	Perkin Elmer DSC7		
Specimen	form	pellets	
	drying	none	
	other preparation	none	
Parameters	purge gas, purity	N2, 99.99%	
	purge gas rate	25	ml/min
	cooling rate	20	°C/min
	initial temperature	260	°C
	final temperature	20	°C
	equilibration time	4	min
	weight	5.48	mg
	sample pans	Al, volatile	
Calibration Standards	temperature	In, Zn	
	heat flow	In	
	specific heat	sapphire	

Technique Notes: Based on the standard.

Heat capacity is a thermodynamic quantity and is a measure of the amount of heat retained by the material. The DSC can measure this property over a range of temperatures and in both solid and melt states.

Testing Notes:

Transition Analysis

extrapolated onset	99	°C
peak / inflection point	95	°C
extrapolated end	89	°C

Specific heat measurements are not included in our current scope of accreditation.

Tested By: *SW*

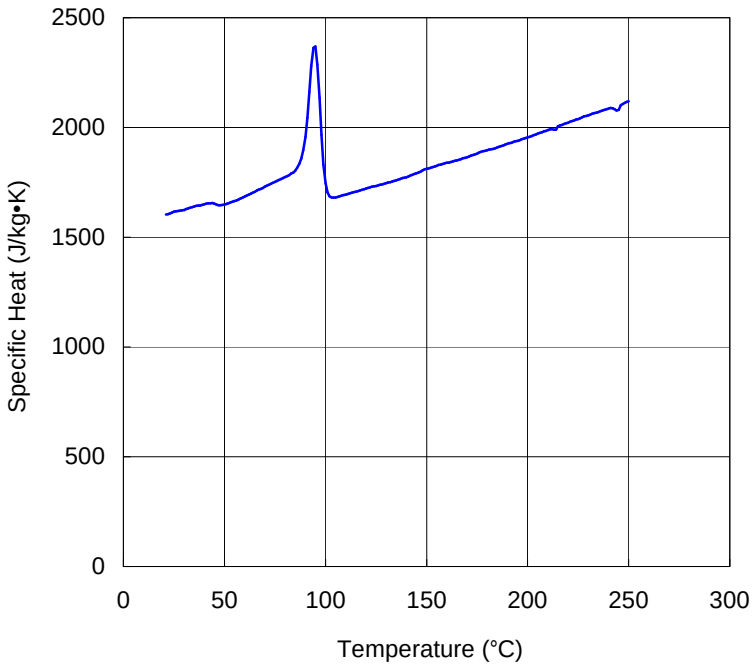
Certified By: *BC*

Test Date: *10/23/2019*

Specific Heat Continued

Specific Heat Data

Temp °C	Cp J/kg•K
250	2119
174	1878
104	1680
95	2369
79	1769
59	1681
30	1625



Thermal Conductivity

Method	ASTM D5930-17 Thermal Conductivity of Plastics by Means of a Transient Line-Source Technique	
Instrument	K-System II Thermal Conductivity System	
Specimen	form	pellets
	drying	3hrs / 80°C / VAC
	other preparation	none
Parameters	calibration material	60,000 cstk PDMS
	probe constant	0.751
	probe length	50 mm
	loading temperature	230 °C
	initial temperature	260 °C
	final temperature	30 °C
	probe voltage	2.5 V
	test duration	45 s
Uncertainty	per standard	

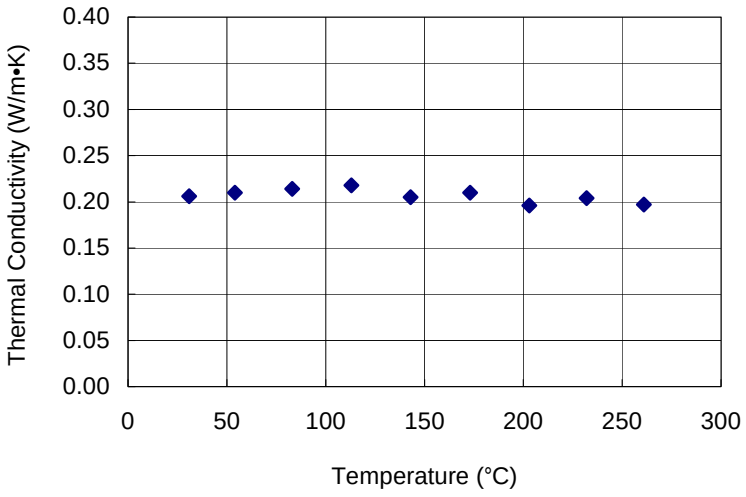
Technique Notes:

Thermal conductivity is a measure of the rate of heat conduction of the material. It is a critical property for heat transfer calculations. The line-source method measures thermal conductivity in both melt and solid state.

Testing Notes:

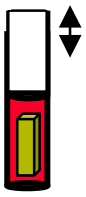
Thermal Conductivity Data

Temp °C	k W/m•K
261	0.197
232	0.204
203	0.196
173	0.210
143	0.205
113	0.218
83	0.214
54	0.210
31	0.206



Tested By: *JC*
Certified By: *SW*
Test Date: *10/24/2019*

PVT



Method	DPL D-020 Pressure-specific volume-temperature measurements using high-pressure dilatometry	
Instrument	Gnomix PVT apparatus	
Specimen	form	plaque
	drying	3 hrs, 80°C/vacuum
	other preparation	cut from plaque
Parameters	solid density method	ASTM D792
	solid density medium	water
	PVT confining fluid	Mercury
	maximum temperature	260 °C
	test mode	isothermal heating scan
	temperature rate	3 °C/min

Technique Notes: *Non-standard/internal standard used.*

PVT data are equation-of-state thermodynamic properties that describe the compressibility and volumetric expansion of the material. Dilatometry measures the change in volume of a specimen subjected to different temperatures and pressures.

Testing Notes:

Initial Solid Density

Density 23°C	1122 kg/m3

PVT measurements are not included in our current scope of accreditation.

0 Data in Matereality as Pressure-Volume-Temperature

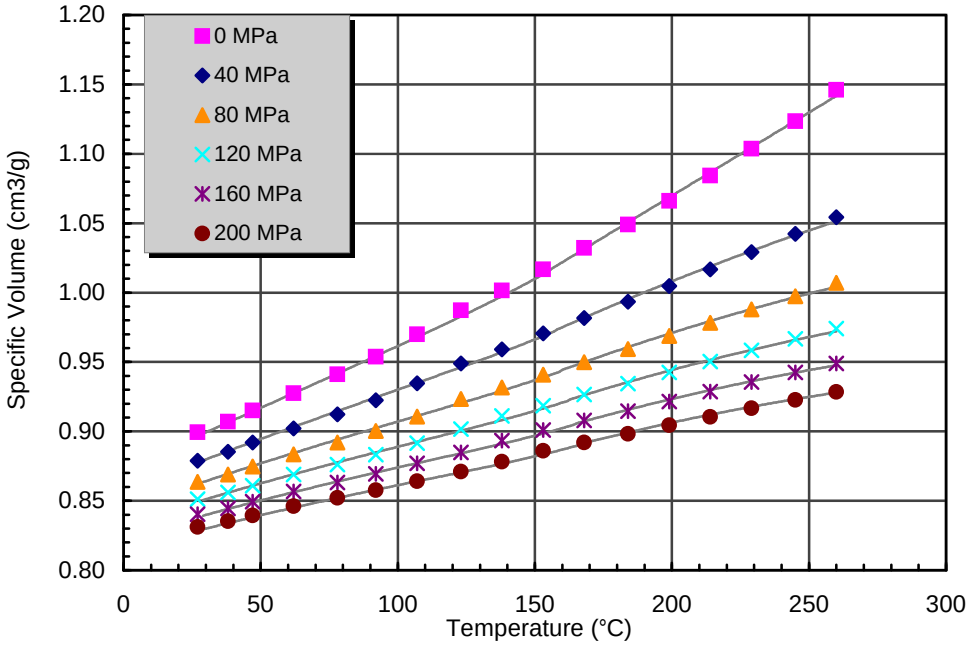
Tested By: *CM*
Certified By: *SW*
Test Date: *10/25/2019*

Pressure-Volume-Temperature Data

Specific Volume cm3/g

Temp	Pressure MPa					
°C	0	40	80	120	160	200
27	0.8993	0.8789	0.8636	0.8512	0.8403	0.8311
38	0.9069	0.8852	0.8690	0.8560	0.8446	0.8353
47	0.9149	0.8920	0.8747	0.8610	0.8494	0.8395
62	0.9274	0.9022	0.8834	0.8689	0.8567	0.8461
78	0.9410	0.9122	0.8919	0.8760	0.8632	0.8522
92	0.9537	0.9225	0.9003	0.8833	0.8694	0.8577
107	0.9700	0.9346	0.9106	0.8916	0.8769	0.8641
123	0.9872	0.9489	0.9233	0.9016	0.8848	0.8709
138	1.0015	0.9592	0.9317	0.9111	0.8933	0.8782
153	1.0166	0.9706	0.9409	0.9185	0.9010	0.8861
168	1.0322	0.9817	0.9499	0.9265	0.9079	0.8920
184	1.0491	0.9933	0.9592	0.9344	0.9146	0.8983
199	1.0660	1.0048	0.9687	0.9424	0.9216	0.9044
214	1.0842	1.0167	0.9781	0.9504	0.9285	0.9105
229	1.1037	1.0292	0.9878	0.9584	0.9355	0.9166
245	1.1235	1.0423	0.9973	0.9666	0.9424	0.9225
260	1.1460	1.0543	1.0070	0.9741	0.9490	0.9284

Modified Two-Domain Tait Model



Coefficients	
b5	1.552E+02
b6	6.050E-02
b1m	1.016E+00
b2m	1.199E-03
b3m	6.202E+01
b4m	7.552E-03
b1s	1.009E+00
b2s	8.771E-04
b3s	6.214E+01
b4s	6.832E-03
b7	6.505E-03
b8	3.706E-02
b9	1.063E-03

Modified Two-Domain Tait Equation

$$\upsilon(T,p)=\upsilon_0(T)\left(1-C\ln\left(1+\frac{p}{B(T)}\right)\right)+\upsilon_t(T,p),\ T_t(p)=b_5+b_6p$$

$$\text{for } T>T_t(p):\ \upsilon_0(T)=b_{1m}+b_{2m}(T-b_5),\ B(T)=b_{3m}\exp\left(-b_{4m}(T-b_5)\right),\ \upsilon_t(T,p)=0$$

$$\text{for } T<T_t(p):\ \upsilon_0(T)=b_{1s}+b_{2s}(T-b_5),\ B(T)=b_{3s}\exp\left(-b_{4s}(T-b_5)\right),\ \upsilon_t(T,p)=b_7\exp\left(b_8(T-b_5)-b_9p\right)$$

Model Terms	Units
specific volume, *u*	cm3/g
pressure, *P*	MPa
temperature, *T*	°C