Frequency Sweep and Temperature Sweep Package

A great test package, for incoming raw material resins, and to determine the viscosity as a function of temperature. In order to successfully predict the processibility of polymer melts, it is important to characterize the viscoelastic properties and the temperature dependency.

The frequency sweep provides information about the molecular weight distribution (MWD) and the weight average molecular weight (Mw). As the crossover frequency decreases the MWD is increasing. The viscosity at lower frequencies, 0.1 rads/sec, is related to the Mw of the polymer.

The temperature ramp provides the dependency of viscosity and insight of the materials melt strength. Also, when a low frequency is used, 1 rad/sec) the test is very sensitive to branching, both long and short, and the materials structure.

This package is available in both cgs and SI units.

Example file: also available in Excel and Quattro.

RE: Polyethylene Melt Rheology

Rheological properties were measured as a sequence test method in accordance with

ASTM D 4440-95a *Standard Practice for Rheological Measurement of Polymer Melts Using Dynamic Procedures,* and

International Standard ISO 6721-10 *Determination of dynamic mechanical properties- Part 10- Complex shear viscosity using a parallel plate oscillatory rheometer*

Typical report has a summary of testing and instrument conditions:

The following summarizes the instrument conditions.	
Instrument	Rheometrics universal stress rheometer SR5, with 25-mm parallel plates
Gap Setting	1.000 mm, Gap was zeroed at 190°C for PE-LD, PE-LLD, and PP
Trim Conditions	@ 190°C
Transducer	0.01 to 500-gram cm range
Environmental System	Electrically heated plates, with disposable plates
Nitrogen Purge	65 ml / minute at 20 psi
Sample Conditioning	Normally samples are dried 8-24 hours prior to testing
Rheometer Calibration	Full calibration performed on Date Listed; Tool and system calibration performed daily

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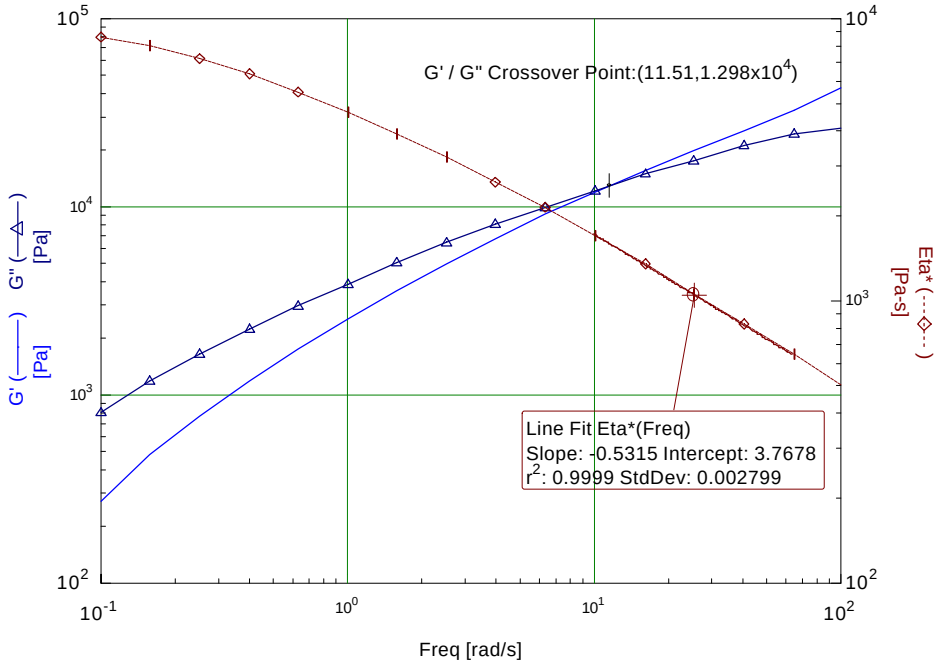
Frequency Sweep

Freq (rads/sec)	G' (Pa)	G" (Pa)	Tan-delta	Eta* (Pa-s)	Temp (C)	Stress (Pa)	Strain (%)	Phase Angle
0.1	274	810	2.958	8553	190	89.028	10.409	71.323
0.2	486	1180	2.429	8050	190	125.97	9.8735	67.624
0.3	773	1642	2.125	7223	190	180.88	9.9697	64.794
0.4	1183	2234	1.888	6349	190	251.25	9.9402	62.094
0.6	1754	2984	1.701	5486	190	346.35	10.006	59.555
1.0	2547	3915	1.537	4671	190	466	9.9769	56.957
1.6	3595	5051	1.405	3912	190	620.35	10.006	54.562
2.5	4991	6424	1.287	3238	190	813.81	10.004	52.154
4.0	6786	8062	1.188	2647	190	1054	10.001	49.911
6.3	9086	9984	1.099	2140	190	1352	10.015	47.696
10.0	11962	12223	1.022	1710	190	1713.3	10.018	45.618
15.8	15564	14815	0.952	1356	190	2152.4	10.017	43.587
25.1	19995	17707	0.886	1063	190	2678.1	10.027	41.527
39.8	25466	20957	0.823	828	190	3304.6	10.02	39.452
63.1	32320	24574	0.760	643	190	4066	10.015	37.247
100.0	42959	26208	0.610	503	190	4452.9	8.8487	31.386

Low density Polyethylene, FS @ 190C



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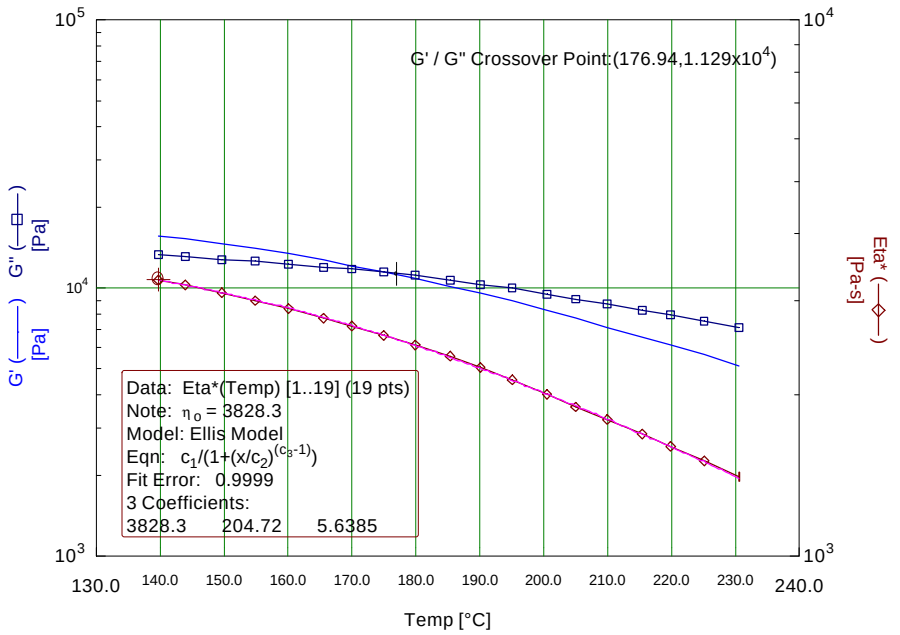
Temperature Sweep

Temp	G'	G"	tan_delta	Eta*	Torque	Phase Angle
°C	Pa	Pa		Pa-s	g-cm	°
139.71	15678	13368	0.85265	3280.8	63.772	40.452
143.98	15251	13126	0.86065	3204.2	63.774	40.717
149.55	14645	12831	0.87614	3100.5	63.776	41.223
154.92	14031	12558	0.895	2998.4	63.778	41.829
160	13413	12277	0.9153	2895.5	63.781	42.468
165.42	12739	11966	0.93925	2783.1	54.84	43.206
169.97	12180	11735	0.96345	2693.2	54.842	43.934
175.04	11535	11410	0.98912	2583.5	54.844	44.687
180.02	10885	11093	1.0192	2474.7	54.847	45.544
185.41	10179	10712	1.0524	2353	46.432	46.462
190.06	9567.4	10350	1.0818	2244.4	46.434	47.251
195.03	8932.6	9966.2	1.1157	2131.1	46.437	48.13
200.43	8256.7	9520.5	1.1531	2006.7	39.622	49.066
205.06	7701.4	9137.9	1.1865	1902.9	39.625	49.876
210.04	7138.2	8734.6	1.2236	1796.2	39.628	50.743
215.45	6563.6	8313.6	1.2666	1686.7	33.308	51.709
219.97	6107.4	7956	1.3027	1597.1	33.311	52.489
225.04	5624.1	7562.1	1.3446	1500.7	33.314	53.361
230.45	5139.8	7164	1.3938	1404	27.755	54.342

Low density Polyethylene, MFI 2.37 g/10 min



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