

2

0

0

Visualization Examples LinXX Rheo

extruders.leistritz.com



Table of content

1	General Issues	.3
2	Start LinXX Rheo	.3
3	LinXX RHEO Monitoring	.4
4	Visualization of viscosity curves	.6
4.1	Display of shear viscosity	6
4.2	Reactive extrusion	7
5	Output of the analysis data in Excel	.8
6	Further information Leistritz LinXX Pilot & Rheo1	.0



1 General information

The LinXX Pilot & Rheo software facilitates the analysis of your process data.

You have the following options, among others, with LinXX Rheo:

- Evaluation of process data from the Leistritz elongation rheometer (LER)
- Display measurement data graphically in diagrams
- The data can be imported from the LDR without further conversion
- Export as Excel file

The following use cases are intended to illustrate the LinXX Rheo module.

2 Start LinXX Rheo

The LinXX Pilot & Rheo program consists of two modules. Only the LinXX Rheo module is used for these visualization examples.



FIGURE 1: SELECTION LINXX RHEO IN THE MAIN MENU

extruders.leistritz.com



3 LinXX RHEO Monitoring

After the data import of the process monitoring data has been made, the shear viscosity, elongational viscosity and other parameters recorded during the process monitoring can be visualized, for example. In this visualization example, a test was made with TPU (=thermoplastic elastomer based on polyurethane).



FIGURE 2: SHEAR VISCOSITY AT LOW SHEAR RATES

The recording shows the shear viscosity of the TPU at low shear rates. At the point where a shear viscosity increase is visible, an additive was added. In this case, a stabilizer was added to protect the material from degradation/oxidation in the process. The following figures (Figures 3 & 4) also show an increase in shear or elongational viscosity due to the addition of additives.





FIGURE 3: SHEAR VISCOSITY AT HIGH SHEAR RATES



FIGURE 4: INCREASE IN ELONGATIONAL VISCOSITY



4 Visualization of viscosity curves

In the following examples, shear as well as elongational viscosity curves were recorded during TPU reactive extrusion.



4.1 Display of shear viscosity

FIGURE 5: DISPLAY OF VISCOSITY CURVES

In the display above, three different tests or samples with the TPU material are shown.

The red dotted line represents a test (No. 1) performed at a speed of 200 rpm.

In blue, a test (No. 2) is displayed that ran at a speed of 300 rpm.

The gray dots represent a test (No. 3) with a speed of 400 rpm.



4.2 Reactive extrusion



FIGURE 6: EFFECT REACTIVE EXTRUSION

After a certain time, the curves change. There is an increase in viscosity over the entire shear rate range due to higher residence time in the extruder.

The speed also influences the dwell time: the lower the speed, the higher the dwell time.

A higher residence time leads to an increase in the reaction conversion, which can result in a higher molecular weight. This results in a higher shear and elongational viscosity.



5 Output of the analysis data in Excel

With the module LinXX Rheo you have the possibility to output all data series in an Excel file.

igen	Calibri	• 8 • 8	11	• A` > • A	A* =		<i>8</i> ∕ €	•	Zeiler Verbi	numbi inden	uch und zer	ntrieren	s •	tandarc • %	000	.0 00 00 00	Be	i ≠ dingte atierun	Al g * for	ls Tabel matiere	le Zel n *	llenform	atvorla *	igen	Einf Lös	ügen • chen • mat •	Σ. 	Sorti	eren un Itern *	d Such Ausi	hen un wähler	id 1 *
enabla	gers + i	Schrift	art V	fx	rs.			Ausi	richtung				E.	Z	ahl	r,			1	Formatv	orlagen	1			Ze	llen			Bearbei	ten		
	в	c	D	E	F	G	н	1	J	к	L	м	N	0	P	Q	в	S	т	U	v	w	×	Ŷ	z	AA	AB	AC	AD	AE	٨F	AG
r Nui rial: Tri	DD.MM.JUU hhMM:SS 1																															
lor: 120 i Ca	gh 275pm 2642 132																															
9-9 8 E	2.08.7968 0.8729888 0.8202 7.2073																															
er Dat	e/Time	n_MP[rev]	o_1(bar)	p_2(bar)	p_3(bar)	p_4[bar]	p_5(bar)	TM_(C)	M_2°CI I	v(Nim)	Q(cmHs)	im_dt[kg q	aop(1):	q_acic2[¥	eta_app10	ita_app2	a_1[¥o]	a_2(10)	ota_1[Pao]	eta_2(Pao	n(+-)	K[Pasîn]	do23(bar) d	p45(bar) i	p3_contb p	of_con[b c	b34_con d	lo34_sher	±b34_elore	politoj e	eta_elong	eta_elony
1 2 3 4	MACO 301 FOE 31 F	10.00	367 37.4 38 385	201.9 238.4 298.8 272.8	86.7 296.7 286.3 286.3	84.7 881 386.1 286.3	10.5 105.8 101.8 101.8	232.4 233.6 233.7 233.8	0 0 0 0	255 36 355 42.0	0.22 0.44 0.66 0.679	0.69 1.38 2.07 2.76	-100 -100 -100 -100	-100 -100 -100 -100	-100 -100 -100 -100	-100 -100 -100	32.5 715 18	805.7 1714 3811.2 4101.5	640.7 501.1 200.0	77.8 41,2 37.8 38.7	0.294	100.8 0894.5 81913 8178.5	8.2 21.7 27.5 30.9	44.8 52.2 56.2 56.4	\$0.42 276.89 235.52 236.28	179.66 205.44 216.76 226.76	2.96 6.44 0.21 0.5	4.82 5.79 6.35 6.82	-0.87 0.66 1.96 2.68	7,6 10,1 20,7 30,2	-1617.3 4344.8 6251.2 6875.8	25393.4 20840.3 17956.8 16237.5
5 6 7 8	1 8.307 1 8.44 1 8.307 1 8.44 1 8.307 1 8.0 8.44 1 8.307 1 8.0 8.44	20 20 20 20 20	10.8 10.1 10.1 10.4	20.7 20.7 20.7 20.5 20.5 20.1	251 2547 254 2747	28.7 28.4 28.4 20.4	98.7 97.4 98.2 97.2	2017 2018 2018 2018 2018		44.5 44.7 40,4 40,4	1,100	2.45 4.31 6.52		- 41	40	100	2012 2024 204.3 275.6	1080.0 6090.0 6090.4 575.5	100.1 101.8 101.8 101.2	10 11 14	0.80	98032.1 20952.4 22539.6 22539.7	12.7 36.1 37.5	42 81 81 82	287 M 280,77 283,97 287 A	27 M 262,5 252,9 254,0	10.0K 10.52 10.46 10.71	7,96 7,23 7,62 7,77	2.98 3,25 2,61 3,54	97.8 45.3 52.9 40.5	70016 7262,8 7240,1 65%,2	1043.1 1043.1 1043.1 1043.1
9	11 16 2027 11 16 22 AM	413	20	36.3	273.6	2953	812	2013	1	63	2.99	625	-	-60	-0	-	4213	UNDLA UNIZZA	907.5	1	15	2002.9	-	814	20.8	28.0	2.04	10	10	-	9876.7	8581,4

FIGURE 7: OUTPUT DATA SERIES IN EXCEL

The following views show the comparison of shear viscosity and elongational viscosity data in the Excel file. Monitoring data sets can also be displayed in Excel using the export function.





FIGURE 8: DIAGRAM SHEAR VISCOSITY



FIGURE 9: ELONGATIONAL VISCOSITY DIAGRAM



6 Do you wish further information Leistritz LinXX Pilot & Rheo?

Do you also want to use and visualize your rheometer or process data optimally?

Then get a non-binding offer for one or more licenses of LinXX Pilot & Rheo!

Our experts will be happy to advise you!

+49 (911) 4306-444

Extrusion-service@leistitz.com

LEISTRITZ Extrusion Technology

At Your Service. Globally.

Leistritz Extrusion Technology Markgrafenstr. 36-39 90459 Nuremberg Germany T +49 911 4306-775 E extruder@leistritz.com

Leistritz France Extrusion Ceyzeriat, France

Leistritz Advanced Technologies Corp. Somerville/NJ, USA

Leistritz Machinery (Taicang) Co., Ltd. Shanghai, China

Leistritz Machinery (Taicang) Co., Ltd. Jiangsu, China

Leistritz SEA Pte. Ltd. Singapore

0