

Virtual Lab Stage 1: Virtual tests with variations of material, part parameters and process parameters

Objectives:

- **Select material**
- **Optimize parts**
- **Optimize process**

- **Makroblend material group**
- **Mold temperature range: 140 - 160 °F**
- **Wall thickness range: 0.08 - 0.12 in.**
- **Minimum elongation at break : 120 %**
- **Maximum filling pressure: 9430 PSI**
- **Maximum total shrinkage 1.25 %**

Question: Which Makroblend grade meets all the requirements?

Virtual Lab Stage 2: Entering test parameters

Click on "Virtual Lab"

1. Select material group

2. Select parameter variation

3. Start calculation

The screenshot shows the 'Variation of influences and target profile' dialog box in the Virtual Lab software. The dialog is divided into several sections:

- Material Selection:** A list of material groups including Apec®, Bayblend®, Makroblend®, and Makrolon®.
- Parameter Variation Table:** A table with columns for Variation, Parameter, Min., Max., Increment, and Value. The 'Mold temperature [°F]' row is highlighted in red, indicating it is selected for variation.
- Calculation Control Panel:** A panel with a 'Generate Values' button and a display showing 'Number of Virtual Experiments: 270'.

The 'Variation of influences and target profile' table is shown in two views: a smaller one in the background and a larger, detailed one in the foreground. The foreground table is as follows:

Variation	Parameter	Min.	Max.	Increment	Value
<input checked="" type="checkbox"/>	Type			<all>	KU1-7304 900000
<input checked="" type="checkbox"/>	Wall thickness [in]	0,0591	0,1575	0,0197	0,0984
<input type="checkbox"/>	Melt temperature [°F]	500,00	536,00	18,00	536,00
<input checked="" type="checkbox"/>	Mold temperature [°F]	140,00	176,00	18,00	176,00
<input type="checkbox"/>	Part volume [in³]	0	305	3	7
<input type="checkbox"/>	max. flow length [in]	0,039	19,685	1,969	7,087
<input type="checkbox"/>	Injection velocity [in/s]	0	20	2	3
<input type="checkbox"/>	Hold Pressure, specific [PSI]	4351	11603	1450	7252
<input type="checkbox"/>	Pressure back flow, specific [PSI]	725	7252	725	2176
<input type="checkbox"/>	Screw rotational speed [1/min]	5	400	50	85
<input type="checkbox"/>	Screw diameter [in]	0,591	7,874	0,394	1,772
<input type="checkbox"/>	Shear rate [1/s]	50	50000	500	1000

Virtual Lab Stage 3: Obtaining test results

Select test results

Design and Processing Properties

File Navigation Extras Contact ?

Bayer MaterialScience

Generation Results

Results

Save selected Save all Delete selected Delete all Export ...

Data Sheet [0 Point(s)]

Load Point

Storage All Results

Parameter	1	2	3	4	5	6	7	8
Name								
Material	Makroblend®	Makroblend®	Makroblend®	Makroblend®	Makroblend®	Makroblend®	Makroblend®	Makroblend®
Type	KU1-7304 900000	KU1-7304 900000	KU1-7304 900000	KU1-7304 900000	KU1-7304 900000	KU1-7304 900000	KU1-7304 900000	KU1-7304 900000
Wall thickness [in]	0,0591	0,0591	0,0591	0,0787	0,0787	0,0787	0,0984	
Melt temperature [°F]	536,00	536,00	536,00	536,00	536,00	536,00	536,00	
Mold temperature [°F]	140,00	158,00	176,00	140,00	158,00	176,00	140,00	
Part volume [in³]	7	7	7	7	7	7	7	
max. flow length [in]	7,087	7,087	7,087	7,087	7,087	7,087	7,087	
Injection velocity [in/s]	3	3	3	3	3	3	3	
Hold Pressure, specific [PSI]	7252	7252	7252	7252	7252	7252	7252	
Pressure back flow, specific [PSI]	2176	2176	2176	2176	2176	2176	2176	
Screw rotational speed [1/min]	85	85	85	85	85	85	85	
Screw diameter [in]	1,772	1,772	1,772	1,772	1,772	1,772	1,772	
Shear rate [1/s]	1000	1000	1000	1000	1000	1000	1000	
Process time [s]	15,8	16,1	16,3	18,5	18,5	18,5	18,5	
Filling time [s]	1,2	1,2	1,2	1,2	1,2	1,2	1,2	
Feeding time [s]	11,2	11,2	11,2	11,2	11,2	11,2	11,2	
Cooling time [s]	6,6	7,2	8,0	11,8	11,8	11,8	11,8	
Freezing time [s]	3,5	3,7	4,0	6,2	6,2	6,2	6,2	
Part mass [oz]	5,3	5,3	5,3	5,3	5,3	5,3	5,3	
Filling pressure [PSI]	19909	19622	19333	11224	1107	1107	1107	
Static friction	0,60	0,64	0,74	0,60	0,6	0,6	0,6	
Sliding friction	0,65	0,66	0,66	0,65	0,65	0,65	0,65	
Molding shrinkage II [%]	0,80	0,82	0,83	0,86	0,86	0,86	0,86	
Molding shrinkage _L [%]	0,76	0,78	0,80	0,80	0,80	0,80	0,80	
Post shrinkage II [%]	0,60	0,51	0,42	0,52	0,4	0,4	0,4	
Post shrinkage _L [%]	0,54	0,47	0,39	0,46	0,3	0,3	0,3	
Total shrinkage II [%]	1,40	1,33	1,25	1,38	1,38	1,38	1,38	
Total shrinkage _L [%]	1,29	1,24	1,19	1,26	1,26	1,26	1,26	
Tensile modulus II [lb/in²]	376247	377381	378667	380746	38175	38175	38175	
Yield stress II [lb/in²]	9585	9640	9699	9663	972	972	972	

Display all

Display all virtual experiments
 Show only products in the target profile
 270 of 270 Experiments fulfills target profile

Display all virtual experiments
 Show only products in the target profile
 270 of 270 Experiments fulfills target profile

Export data to Excel

Save

Speichern in: ATI

Verlauf

Desktop

Arbeitsplatz - ...

Netzwerkung...

Dateiname: Makroblend Trial No 1.xls

Dateityp: Excel Files (*.xls)

Speichern

Abbrechen

Virtual Lab Stage 4: Entering the target profile

Click on the "Generation" tab

Copy into target profile Copy from target profile

Alternatively, copy from target profile

The screenshot shows the 'Design and Processing Properties' window with the 'Generation' tab selected. The interface includes a sidebar with icons for Design, Processing, Rheological, Mechanical, Virtual Lab, Data Sheet, and Product Info. The main area is divided into 'Material', 'Variation of influences and target profile', and 'Calculation' sections.

Variation of influences and target profile table:

Variation	Parameter	Min.	Max.	Increment	Value
<input checked="" type="checkbox"/>	Type			<all>	KU2-7912 900000
<input checked="" type="checkbox"/>	Wall thickness [in]	0,0591	0,1575	0,0197	0,0984
<input type="checkbox"/>	Melt temperature [°F]	500,00	536,00	18,00	536,00
<input checked="" type="checkbox"/>	Mold temperature [°F]	140,00	176,00	18,00	176,00
<input type="checkbox"/>	Part volume [in³]	0	305	3	7
<input type="checkbox"/>	max. flow length [in]	0,039	19,685	1,969	7,087
<input type="checkbox"/>	Injection velocity [in/s]	0	20	2	3
<input type="checkbox"/>	Hold Pressure, specific [PSI]	4351	11603	1450	7252
<input type="checkbox"/>	Pressure back flow, specific [PSI]	725	7252	725	2176
<input type="checkbox"/>	Screw rotational speed [1/min]	5	400	50	85
<input type="checkbox"/>	Screw diameter [in]	0,591	7,874	0,394	1,772
<input type="checkbox"/>	Shear rate [1/s]	50	50000	500	1000

Data Sheet [0 Point(s)] table:

Property	Min.	Max.
Freezing time [s]	0,0	50,0
Part mass [oz]	0,0	211,6
Filling pressure [PSI]	0	9430
Static friction	0,00	0,80
Sliding friction	0,00	1,50
Molding shrinkage II [%]	0,00	3,00
Molding shrinkage _L [%]	0,00	3,00
Post shrinkage II [%]	0,00	2,00
Post shrinkage _L [%]	0,00	2,00
Total shrinkage II [%]	0,00	1,00
Total shrinkage _L [%]	0,00	5,00
Tensile modulus II [lb/in²]	250000	290000
Yield stress II [lb/in²]	1450	14504
Yield strain II [%]	145,0	1450,4

Calculation section:

Number of Virtual Experiments: 270

8 of 270 Experiments fulfill target profile

Enter min. and/or max. for target profile and press Enter to activate

8 of 270 Experiments fulfill target profile

Virtual Lab Stage 5: View results in target profile

Click on "Results" tab

- Display all virtual experiments
- Show only products in the target profile

8 of 270 Experiments fulfills target profile

Design and Processing Properties

File Navigation Extras Contact ?

Bayer MaterialScience

Generation Results

Results

Save selected Save all Delete selected Delete all Export ...

Parameter	1	2	3	4	5	6	7	8
Name								
Material	Makroblend®	Makroblend®	Makroblend®	Makroblend®	Makroblend®	Makroblend®	Makroblend®	Makroblend®
Type	KU2-7912/5 900000	KU2-7912/5	KU2-7912/5	KU2-7912/5	KU2-7912/5	KU2-7912/5	KU2-7912/5	KU2-7912/5
Wall thickness [in]								
Melt temperature [°F]								
Mold temperature [°F]								
Part volume [in³]								
max. flow length [in]								
Injection velocity [in/s]								
Hold Pressure, spec								
Pressure back flow,								
Screw rotational spe								
Screw diameter [in]								
Shear rate [1/s]								
Process time [s]								
Filling time [s]	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
Feeding time [s]	11,2	11,2	11,2	11,2	11,2	11,2	11,2	11,2
Cooling time [s]	16,3	25,6	26,3	31,6	34,8	38,7	42,1	48,3
						19,7	20,4	23,4
						5,0	5,0	5,0
						1920	192	
						0,53	0,7	
						0,66	0,6	
						0,74	0,7	
						0,89	0,9	
						0,26	0,2	
						0,23	0,1	
						0,99	0,9	
						1,12	1,06	1,10
						283939	284423	287748
Yield stress II [lb/in²]	7611	7637	7309	7241	7311	7231	7298	7262

Display all

Eight trials with Makroblend KU2-7912/5 meet the target profile requirements

Save data to "Data Sheet" module, delete, or export to Excel

Virtual Lab Stage 6: Loading and deleting results

Design and Processing Properties

- File
- Navigation
- Extras
- Contact ?

Screw Geometry

Display Data Sheet Control

Options

Data Sheet [0 Point(s)]

Storage All Results Results in target profile

Load Point 0 Delete

Display all virtual experiments

Show only products in the target profile

8 of 270 Experiments fulfills target profile

	1	2	3	4	5	6	7	8
Makroblend®	Makroblend®							
KU2-7912/5 900000	KU2-7912/5							
0,0787	0,0984							
536,00	515,00							
176,00	118,00							
7								
7,087	7,087							
3								
252	7252							
176	2176	2176	2176	2176	2176	2176	2176	2176
85	85	85	85	85	85	85	85	85
772	1,772	1,772	1,772	1,772	1,772	1,772	1,772	1,772
1000	1000	1000	1000	1000	1000	1000	1000	1000
20,4	26,8	27,5	32,8	36,0	39,9	43,2	49,5	
1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2
11,2	11,2	11,2	11,2	11,2	11,2	11,2	11,2	11,2
6,3	25,6	26,3	31,6	34,8	38,7	42,1	48,3	
8,0	12,6	12,8	16,1	16,9	19,7	20,4	23,4	
5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0	5,0
7982	4599	4672	2986	2984	1920	1920	1198	
0,73	0,73	0,75	0,53	0,75	0,53	0,75	0,75	
0,66	0,66	0,66	0,66	0,66	0,66	0,66	0,66	

Enter individual calculation rows under: “point ...” or with the right or left arrow key.

Using the storage function, save individual calculation results from Virtual Lab (all results, results in target profile) or Datasheet (storage) to the target profile of the processing and mechanical module, or delete such results.