Zwick / Roell

Intelligent testing

Polymer testing:
ZwickRoell plastometers for the determination of melt flow indexes MFR and MVR

Mareike Arnold

testXpo 2018

Agenda

ZwickRoell offers a comprehensive range of high quality plastometers

- **Standards, operating principles and methods**
- **Cflow and Mflow plastometers**
- **The Mflow weight pre-selector**
- **The Aflow extrusion plastometer**
- **Software functions**

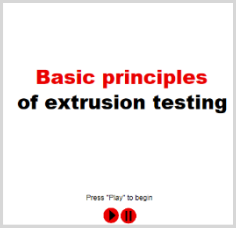
ZwickRoell extrusion plastometers fulfill all commonly used global testing standards

- **ISO 1133 (part 1 and part 2)**
- **ASTM D 1238**
- JIS K 7210
  (Version 10/1999, identic to ISO 1133)
- ASTM D 3364 (specific for PVC)

Operating principle

Melt flow rates represent the speed of extrusion of a polymer under defined temperature, through a defined die and under a defined constant pressure.

www.zwickroell.com



Method A

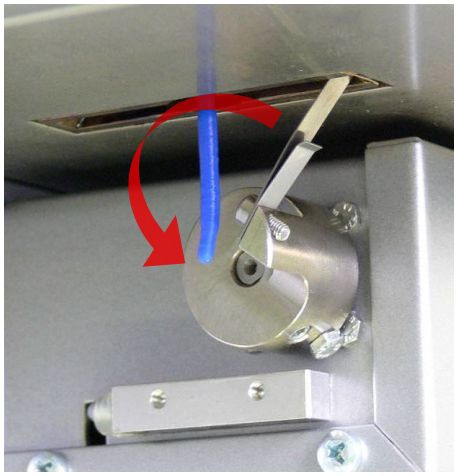
The melt-mass flow-rate is determined by weighting extrudates cut-off in known intervals.

Method A – MFR (Melt Mass Flow Rate)

The extrudates are cut off at constant time intervals.

- cut-off lengths between 10 and 20mm
- the time interval must not exceed 240s
- maximum test time 25 min.

The cut-offs are weighed on analytical scales and the result is stated in **g/10min.**



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Range of application

- simple manual testing (low specimen volumes)
- filled plastics

The melt-mass flow-rate is determined from piston travel measurement.

Method B – MVR (Melt Volume Rate)

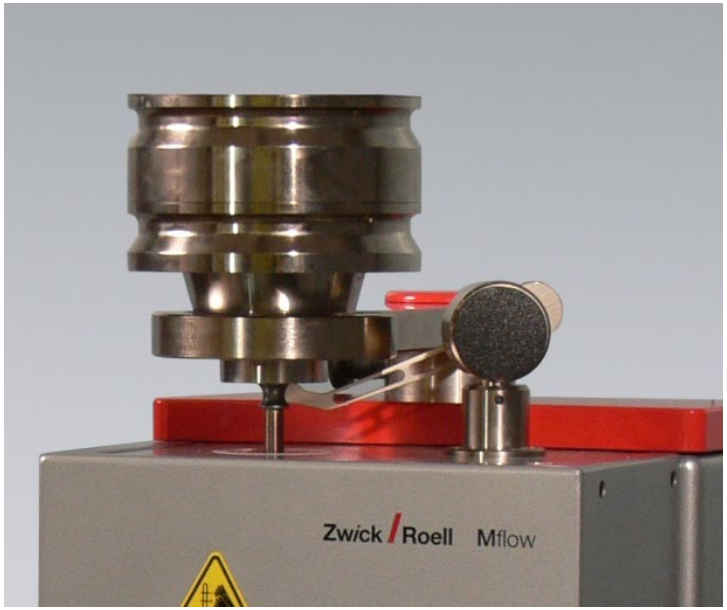
Measurement of piston travel per time and conversion to extruded volume per time

- measurement interval can be travel or time-controlled
- time interval shall not exceed 240s
- maximum test time 25 min.

The result is stated in **cm³/10min.**

Range of application

- medium to high specimen volumes
- more automatic test sequences



ISO versus ASTM

Zwick / Roell

ISO and ASTM procedures are different in several conditions, but the same equipment can be used for both standards.

Topic	ISO 1133-1	ISO 1133-2 (moisture sensitive & time dependend materials)	ASTM
Filling Quantity	3 to 5 g for flowrates 0.1 to 0.5 g/10min	not standardized	2.5 to 3 g for flowrates 0.15 to 1 g/10min
	4 to 6 g for flowrates > 0.5 g/10min	not standardized	3 to 5g for flowrates > 1 g/10min
	4 to 8 g for flowrates > 3.5 g/10min	4 - 5 g for flowrates 10 to 20 g/10min	4 to 8 g for flowrates > 3.5 g/10 min
		5 - 6 g for flowrates > 20 g/10min	
		6 - 7 g for flowrates > 30 g/10min	
		> 7 g for flowrates > 40 g/10min	
Preheat	loading of the material charge within 1 min	loading of the material charge within 1 min	loading of the material charge within 1 min
	5 min of preheat time, followed by the time needed to reach the start position 50 mm (no exact tolerance for the maximum preheat time)	5 min of preheat time, start position 50 mm must be reached at 5.75 ± 0.25 min after charging was completed	7 ± 0.5 min until start of measurements at a position of 46 ± 2 mm (double condition!)
Pre-compaction	Piston may be loaded, unloaded of partly loaded durin pre-heat. Purging must be completed latest 2 min before measurements begin and shall not take longer 1 min.	No specific limitations. Piston may be loaded, unloaded of partly loaded during pre-heat.	Purging must be completed latest 2 min before measurements begin.
Method A	Maximum time per measurement = 240 s	Maximum time per measurement = 240 s	Measurement at fixed time intervals:
	Maximum time im the barrel = 25 min	Maximum time im the barrel = 25 min	6 min for MFR 0,15 to 1 g/10min
	Any cutting time allowed, preferred filament length is 10 to 20 mm	Any cutting time allowed, provided that the filament length is > 10 mm. Use all cut filaments within the avail. 30 mm of piston travel for the result calculation.	3 min for MFR 1 to 3.5 g/10min 1 min for MFR 3.5 to 10 g/10min 0.5 min for MFR 10 to 25 g/10 min 0.25 min for MFR > 25 g/10 min
Method B	Maximum time per measurement = 240 s	Maximum time per measurement = 240 s	MVR up to 10 --> 6.35 ± 0.25 mm
	Maximum time im the barrel = 25 min	Maximum time im the barrel = 25 min	MVR > 10 --> 25.4 ± 0.25 mm
	Every possible measurement travel and times are allowed. Standard indicates preferred values.	Fixed measurement travel between 20 and 30 mm	

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Extrusion tests

The Xflow series – the ideal extrusion plastometer for every testing situation.

Cflow
Compact

- manual instrument for goods inwards checks
- fast, reliable testing to Method A

Mflow
Modular

- modular instrument for higher testing volumes
- low-cost entry, capable of successive expansion

Aflow
All-round

- handy all-rounder for 24-hour operation
- optimum test sequence - efficient and reliable

Higher testing volume, higher level of automation, greater convenience

ZwickRoell supplies extrusion plastometers for all processing stages of the polymer industry.

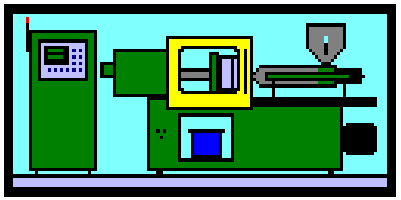
Raw material producer

SOLVAY · سابك sabic · EXXON · DOW Living. Improved daily. · degussa. · LG Chem · imagination at work · basell Polyolefins · BOREALIS SHAPING the FUTURE with PLASTICS · Ticona ENGINEERING POLYMERS · BASF The Chemical Company · Bayer MaterialScience

Compounder

PolyOne · RADICIPLASTICS · thermoplastiques TCT COUSIN-TESSIER · EUROCOMPOUND · polykemi · multibase A Dow Corning Company

Processors



KTP · 3M Worldwide · Kunststoff Palettentechnik GmbH · PIPELIFE · etimex · PVS-Kunststofftechnik · wavin · +GF+ GEORG FISCHER PIPING SYSTEMS · tesa

Aflow

Mflow

Cflow

Cflow is a compact, cost-efficient extrusion plastometer for manual testing.

- weights up to 21.6 kg
- precise temperature control
- stand-alone operation
- manual and automatic extrudate cutter
- optional die-plug
- optional supplementary weights
- optional safety door

Mflow's modular design enables easy upgrading. It was developed to meet the needs of R&D, QA and goods inwards checks.

- the modular design allows upgrades and retrofits
  - extrudate cutters (manual/motorized)
  - displacement transducer for MVR measurement
  - weight-lifting unit / weight pre-selector
- weights up to 21.6 kg
- automatic parameter control (APC)
- testXpert® II connection via USB
- multiple **X**flow instrument operation with one PC
- precise temperature control to ISO 1133-2
- stand-alone or PC controlled operation

Mflow: Purge and clean function

A fully integrated purge an clean function is available as an option for the Mflow plastometers.

Purge & pre-compaction

- Load control by manual pre-set of the pneumatic pressure
- Purging & pre-compaction up to a pre-set position

Cleaning function

- Specific cleaning rod
- Push-button operation
- Always full pressure

Advantages:

- Purging & pre-compaction during pre-heat
- Purging after test
- Cleaning after test
- Ease of operation ! Constant pre-compaction !

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The Mflow weight selector simplifies using different weights.

- easy selection of test weights
- secure storage of test weights
- test weight set includes all common weights: 1.2 kg, 2.16 kg, 3.8 kg, 5 kg, 8.7 kg, 12.5 kg, 20 kg and 21.6 kg
- piston weight = 0.325 kg
- the special 1.05 kg or 1 kg test weights can be used in place of the 1.2 kg weight
- can be retrofitted to all **M**flow extrusion plastometers

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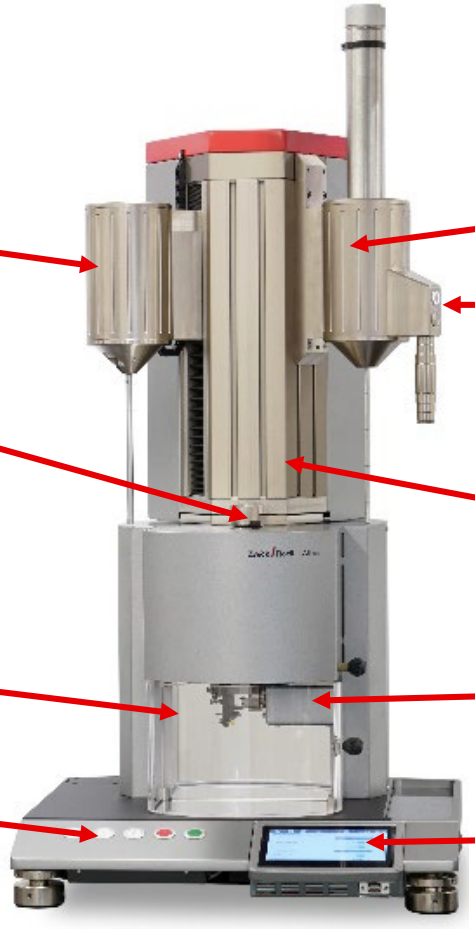
The Aflow

The Aflow is a semi-automatic plastometer designed for extensive use with changing operators.



Test head with special heat insulation

Swiveling funnel für granulates

Safety door (optional)

Operating elements (Start, Stop, Cut ...)

Pre-compaction and cleaning device (optional)

Changeover to pre-compacting (option for cleaning device)

Swivel plane

Extrudate cutter (optional) and die-plug (optional)

Instrument electronics (stand-alone operation possible)

The Aflow

The innovative Aflow extrusion plastometer is the right choice for customers who value operator convenience or have a high testing rate.

- optimized, operator-independent test sequence
- automatic parameter control (APC)
- stepless test load adjustment up to 50kg
- rapid residual material extrusion after test
- uniform pre-compacting and labor-saving cleaning at the push of a button (optional)
- time-saving multi-stage tests
- intelligent testXpert® II connection via USB
- space-saving multiple instrument operation with up to 6 **A**flow/**M**flow instruments on one PC
- precise temperature control to ISO 1133-2
- convenient stand-alone operation

Efficient and reliable – The Aflow's test sequence ensures repeatable and reproducible test results in a short period of time.

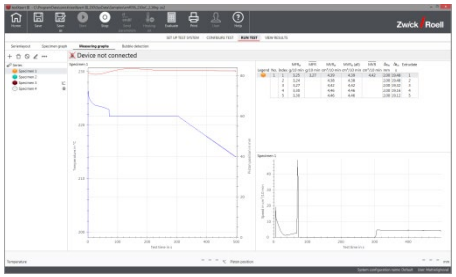
1 

Fill with granulate quickly and easy using the self-centering hopper
.

2 

Compact your materials in a defined manner, regardless of the operator

3 Select test loads ranging from 0.325 kg to 50 kg steplessly without weights
.



4 Take advantage of simple, flexible configuration and evaluation of ZwickRoell testing software
.

5 Expel residual material at up to 80 kg

6 

Cleaning is made simple at the touch of a button

The **A**flow
The comfortable all-rounder

The Aflow

The die-plug allows highly fluid thermoplastics to be tested

- die-plug is positioned manually and automatically removed by the extrudate cutter at the end of the pre-heating period
- no loss of specimen material during pre-heat
- As the Aflow can completely stop the piston, this option is only needed for polymers with very high MFR already at low loads.

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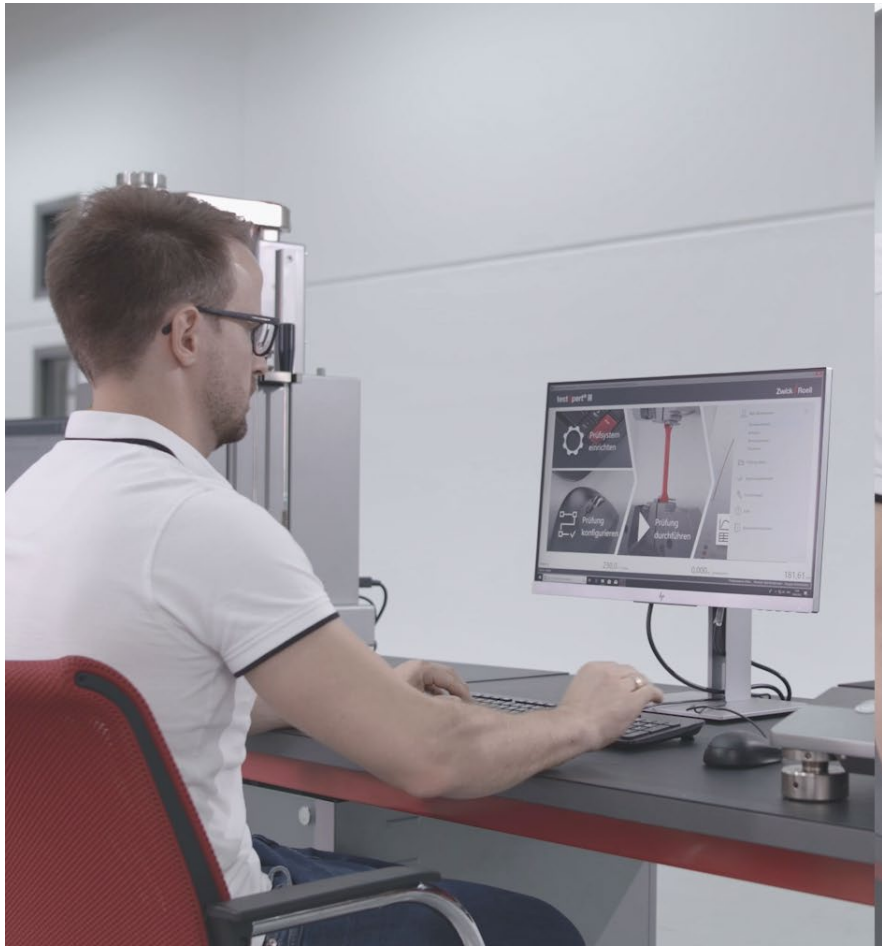
Xflows

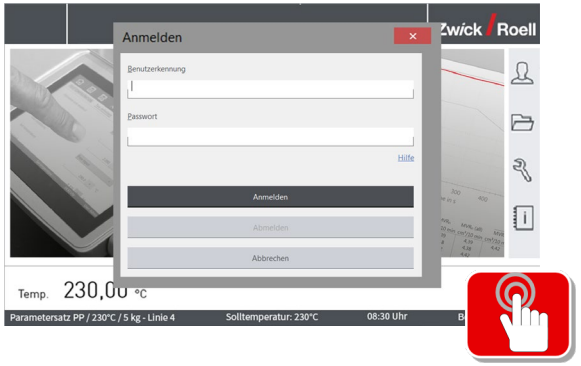

Prüfsystem einrichten
Prüfung konfigurieren
Prüfung durchführen

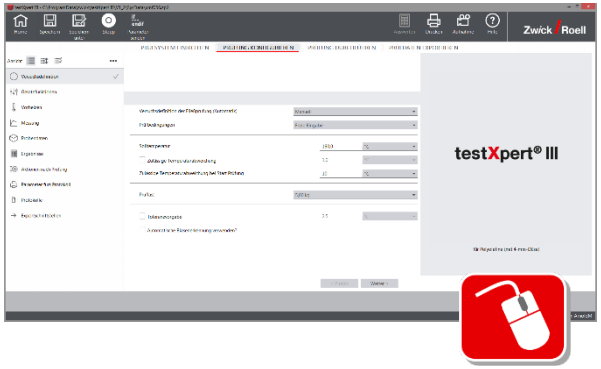

Zwick/Roell
Aflow

Xflows

Next generation Xflows – modern and designed for tomorrow's technology.

- Flexible use with or without a PC
- Intuitive and workflow-based right from the start!
- Quick familiarization with user management



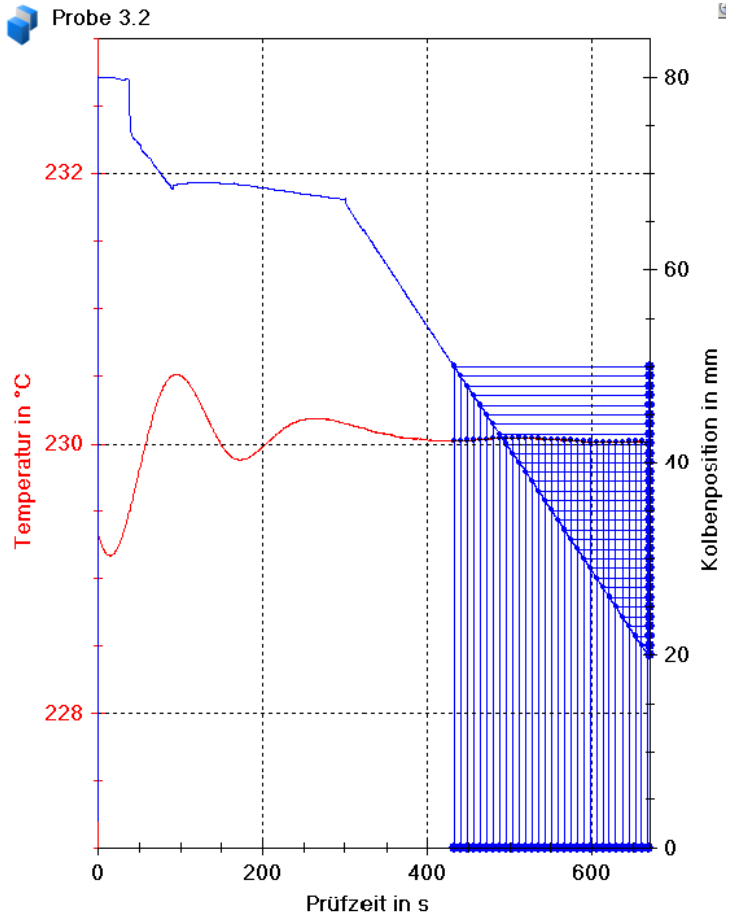


Up to six Xflow plastometers can be controlled by one PC

- Control of up to 6 **A**flow/**M**flow plastometers via one PC
- connection via Ethernet Switch

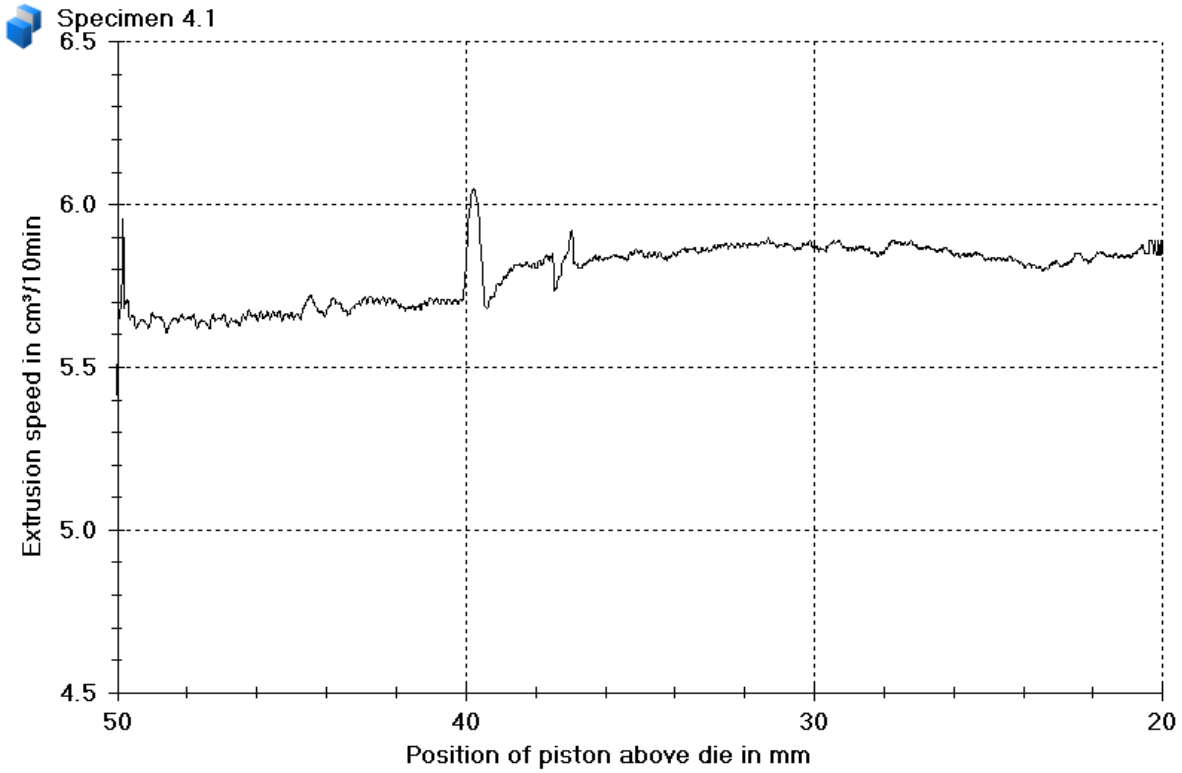
testXpert III and the stand alone display allow exact supervision of the entire test sequence

- The software collects temperature, travel and time measurements at a high acquisition rate.
- Diagrams give a compete view of all test sequences in a Temperature-Travel-Time diagram.
- By storing these test curves or diagrams, the procedure becomes traceable for later analysis in case of doubts.



Mflow and Aflow plastometers perform several hundred MVR measurements on one single barrel filling.

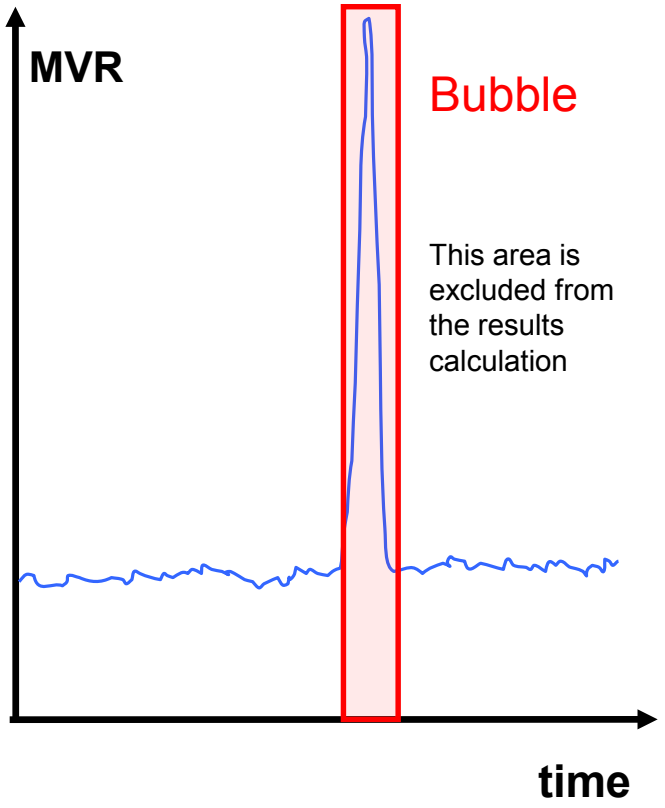
- An extrusion speed diagram indicates local MVR values measured at short time intervals.
- Knowledge of such local MVR values allows sensitive supervision of the test sequence, for example recognition of bubbles or other defects.



Recognition of gas inclusions

The testXpert software recognizes and excludes measurement effects caused by air bubbles.

- Gas inclusions (air bubbles) in the material lead to instantaneous high piston speeds, falsifying the MVR results.
- The testXpert software for ZwickRoell plastometers detects and eliminates such areas from the test curve.
- The standardized outlier-test is still available.



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