HAAKE PolyLab QC Capillary Rheology Configuration

Author
Matthias Jährling
Thermo Fisher Scientific, Karlsruhe, Germany

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A Thermo Scientific™ HAAKE™ PolyLab™ QC Capillary Rheology Configuration is available for measuring the rheological flow behavior of polymer melts.

The configuration consists of a HAAKE PolyLab QC Drive Unit, the HAAKE PolySoft OS Capillary Software, a HAAKE Rheomex 19/25 QC Single-Screw Extruder, a 19/25 Metering Screw (3:1 compression), and a Rod-Capillary Die with four capillary nozzles.

Extruder capillary rheology allows the viscosity behavior of polymer melts to be measured under production conditions. The extruder plastification of the sample avoids the problems of material degradation that usually affect measurements with conventional, piston-type capillary rheometers. The extruder always feeds fresh polymer melt to the measuring capillary. The time from the introduction of the pellet to the measurement of the molten material is typically less than two minutes. Additionally, the extruder hopper can be flushed with inert gas, which further helps to prevent material degradation.

When changing between measuring samples, the extruder capillary rheometer shows another significant advantage, because the sample is changed by simply rinsing out the old sample with the new one. Additional cleaning is not necessary.

Capillary rheology configuration has additional advantages:

- Extruder plastification also allows the measurement of the viscosity behavior of samples that cannot be measured with conventional capillary rheometers or rotational rheometers—for example, PVC Dry Blends.
- The measurement is not limited to the small volume of a heated cylinder. As long as the extruder is filled with sample material, the system can generate measuring results.
- The extruder setup can also be used for other purposes, like profile extrusion.

Measuring principle

The extruder produces a homogeneous, fully molten polymer melt, which is then transported to a die head with a measuring capillary. The melt is pressed through this measuring capillary. Depending on the viscosity of the melt, a corresponding pressure is generated, which is measured to calculate the shear stress in the capillary.

Shear stress: $\tau = \frac{r}{2} \bullet p'$

After the capillary, the mass output is measured over the measuring time by means of a balance. From this measured mass flow, the corresponding volume flow is calculated, and from this the shear rate in the capillary can be determined.

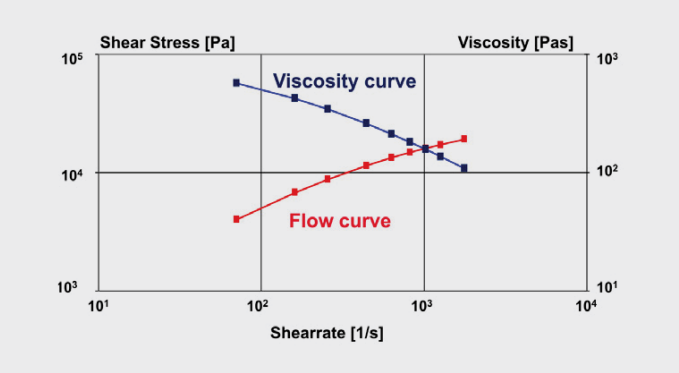
Shear Rate: $\dot{\gamma} = \frac{4 \bullet Q}{\pi \bullet r^3}$

Knowing the shear stress and the shear rate allows for the calculation of the sample's viscosity.

Viscosity: $\eta = \frac{\tau}{\dot{\gamma}}$

HAAKE PolyLab QC with Rheomex 19/25 QC Extruder.

By changing the screw speed of the extruder step by step, different shear rates are set. At each speed step, shear stress and shear rate are measured, and the viscosity is calculated. In this way, the viscosity function of a polymer melt is determined.



Example: Viscosity measurement.

PolySoft Capillary Software

The HAAKE PolySoft OS Capillary Software is specifically designed for performing capillary rheological measurements:

- It guides the user through the test and helps to avoid false results caused by wrong handling.
- It independently carries out the measurement steps and controls the individual test steps
- It calculates the rheological values and carries out the necessary corrections (e.g., Bagley correction, Weissenberg/Rabinowitsch correction).
- It enables regression analyses to determine rheological parameters for computer simulations. It serves as a database for all measurements carried out, for further references and data comparisons.

Ordering information for a typical system:

Description	Order number
HAAKE PolyLab QC	567-0058
PolySoft OS Capillary Software	567-6020
Rheomex 19/25 QC	567-2110
19/25 Metering Screw 3:1 compression	557-2025
Hopper with closure	567-2420
Vertical Rod Capillary Die	557-3100
Capillary nozzle D: 1.5 mm, 10 L/D	557-2544
Capillary nozzle D: 1.5 mm, 20 L/D	557-2545
Capillary nozzle D: 1.5 mm, 30 L/D	557-2546
Capillary nozzle D: 1.5 mm, 40 L/D	557-2547
Electronical Balance	557-4110
Pressure sensor CANopen 500 bar	567-2305
Melt temperature sensor, CANopen	567-2340

Learn more at **thermofisher.com/polylabqc**