DataPower

Usable results of exact relation between MWD and rheological properties.

DataPower Server for CAE programs

DataPower Server
RheoFlow Client

DataPower Server is a stand-alone program sending synchronised viscoelastic data to any client program in same or remote PCs by TCP/IP protocol.

- DataPower Server is based on the RheoPower principle.
- Computer Aided Engineering (CAE) Client programs are not platform depended.
- RheoFlow CAE Client program is developed for calibration and simulation.
- RheoFlow can simulate basic flow channels by DataPower Server data.
- DataPower Server can make very fast data feeds according to data requests for any CAE/CAD/CFD Client.

DataPower Server gives Data:
- *At different temperatures,*
- *pressures and*
- *with known shear history.*
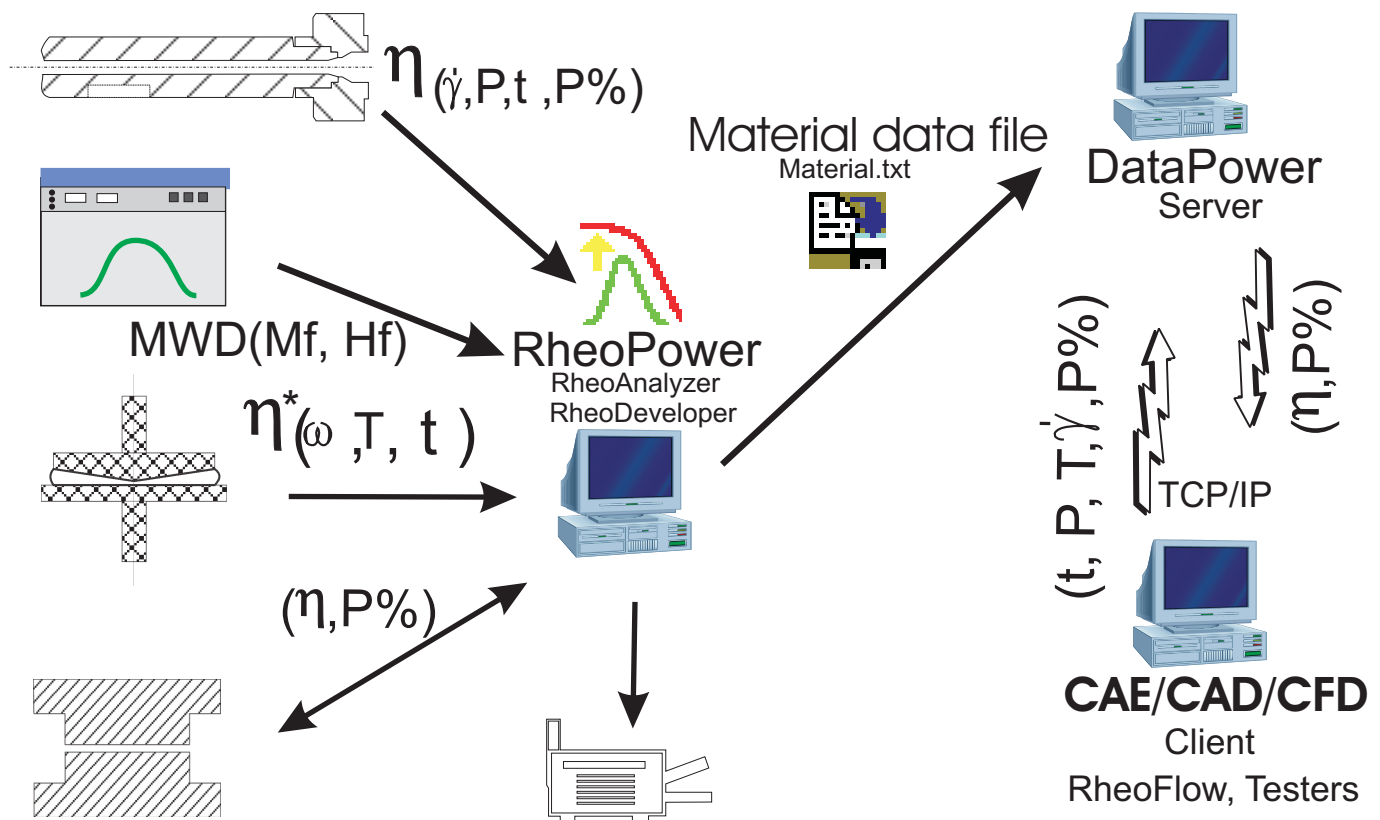
DataPower outputs can be used for:
- *Simulation of injection moulding and extrusion processes.*
- *Orientation effects: shrinkage and warppage.*
- *Deeper understanding of capillary measurements.*
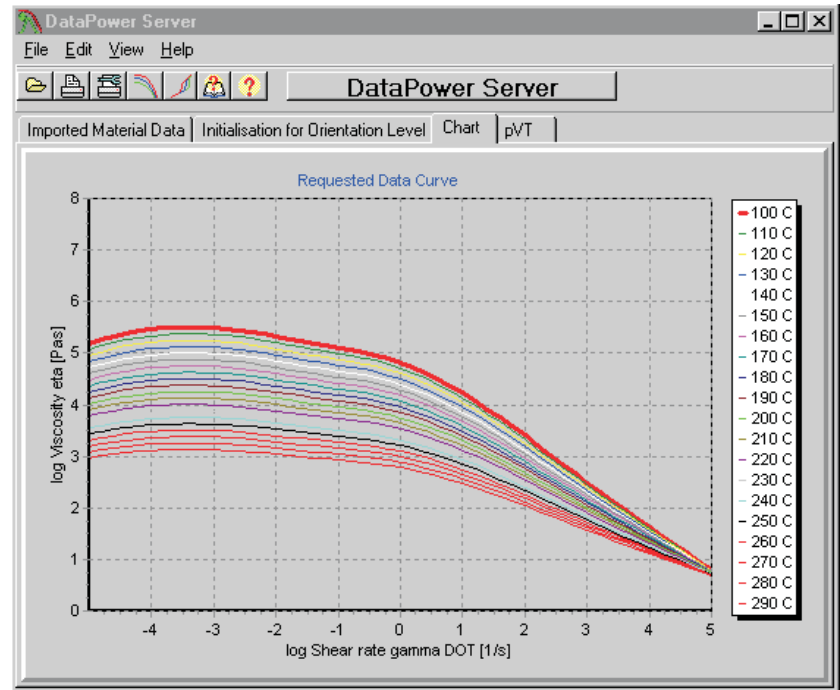
DataPower Server program sends viscoelastic synchronised data computed from a polymer material datafile. The use of Server is very simple. Figure shows viscosity curves of a material data file.
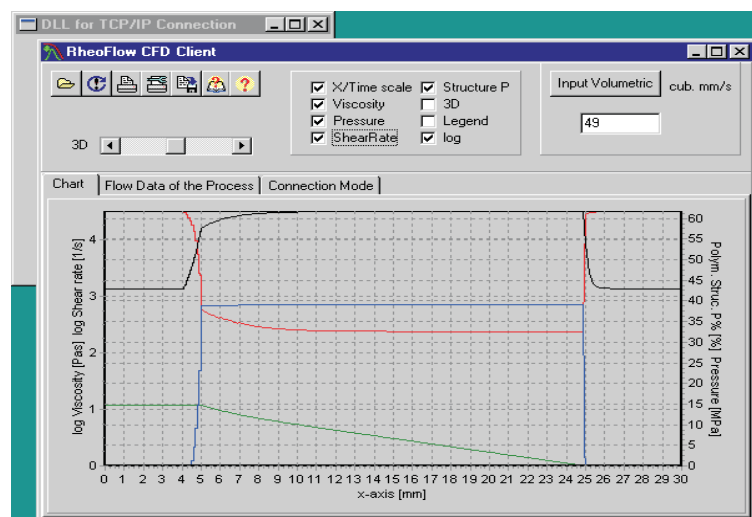
RheoFlow Client program simulates flow in the L/D=20 capillary as a function of x-coordinate. The red line is log transition viscosity, blue is log shear rate, green is pressure and black is the orientation level P%. On the back left is DLL connector for TCP/IP.

$\eta_{(\dot{\gamma},P,t,P\%)}$

MWD(Mf, Hf)

Material data file
Material.txt

DataPower
Server

RheoPower
RheoAnalyzer
RheoDeveloper

$\eta^*_{(\omega,T,t)}$

$(\eta,P\%)$

$(t, P, T, \dot{\gamma}, P\%)$

$(\eta,P\%)$

TCP/IP

CAE/CAD/CFD
Client
RheoFlow, Testers

RheoPower software family delivers material data files for separate DataPower Server. This can be located in same computer with CAE/CAD/CFD Client software or remote mode is saving computation resources. Client program gets flow and rate synchronized viscoelastic data by TCP/IP protocol in the ready use mode. DataPower can serve also CAE/CAD/CDF programs on Linux/Unix platforms.

The Software Family

- The DataPower Server and modern TCP/IP protocol presents the backbone.

- RheoPower is a comprehensive software family for polymer structure analyses and a source for DataPower software family.

- Modern flexible coding technique offers rapid scalability for special applications.

- RheoFlow is CAE Client for flow simulations of basic channel shapes.

- RheoTester Client and a DLL program with open source code gives coding instructions for making Client TCP/IP interface.

- Material and process data files are included.

Data Functions in the Fast Synchronised Mode

A CAE client program makes a data request for viscoelastic functions at a temperature and pressure with shear history information.

DataPower Server gives requested data back in few milliseconds.

Client/Server Principle

Client/Server describes the relationship between two computer programs in which one program, the client, makes a service request from another program, the server, which fulfills the request. The Client/Server idea can be used by programs within a single computer or in a network.

The Server-Client architecture offers ready tools for high-performance parallel and distributed computing saving system resources and speeding up computation time.

Procedure Description

New polymer is measured by oscillating and capillary rheometer for making material data. Results are composed to a datafile in RheoAnalyzer program, a member of RheoPower software family.

This datafile is imported to the DataPower Server, which is now ready to give to any CAE Clients different type viscoelastic data at different time steps, temperatures, pressure and shear history.

DataPower Server delivers Viscoelastic Data

DataPower is stand-alone server program by TCP/IP connection made by any CAE, Computational Fluid Dynamics (CFD) and Computer Aid Design (CAD) client programs.

Performance

DataPower generates in few milliseconds the data response. On IP/TCP network connection mode DataPower can serve many clients simultaneously located on separate PCs up to supercomputers.
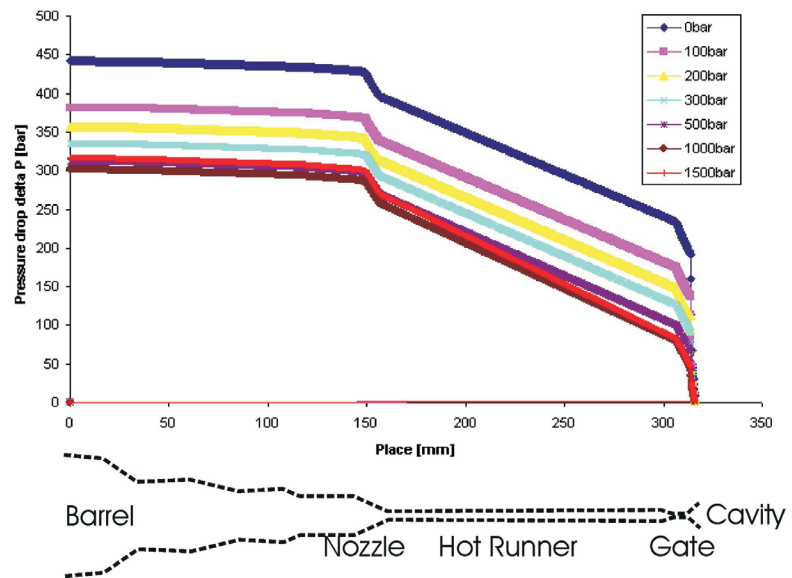
RheoFlow Client program simulates pressure differences at different cavity pressures. The blue with 0bar curve shows higher 445bar pressure loss between barrel and gate compared 300bar for full filled 1000bar at cavity start. At higher cavity pressures as 1500bar pressure difference starts to rise.

Transient Shear Flow and Viscosity

Polymer has a wide range of sudden shear rate changes during extrusion and injection moulding processes.

Transition Viscosity $\eta(\dot{\gamma},t)$ is true effective viscosity included with shear history and value of it approaches steady state viscosity during time.

Viscosity of two variables

Viscosity varies strongly during deformations not only as function of shear rate but also time or $\eta(\dot{\gamma},t)$.

These step strains are studied mainly with simple principal cases in rheology and not much for practical purposes.

Many software, models and meshing methods are available in the CAE programs, but there is a great lack of time-dependent and synchronised true viscoelastic data of polymer melts.
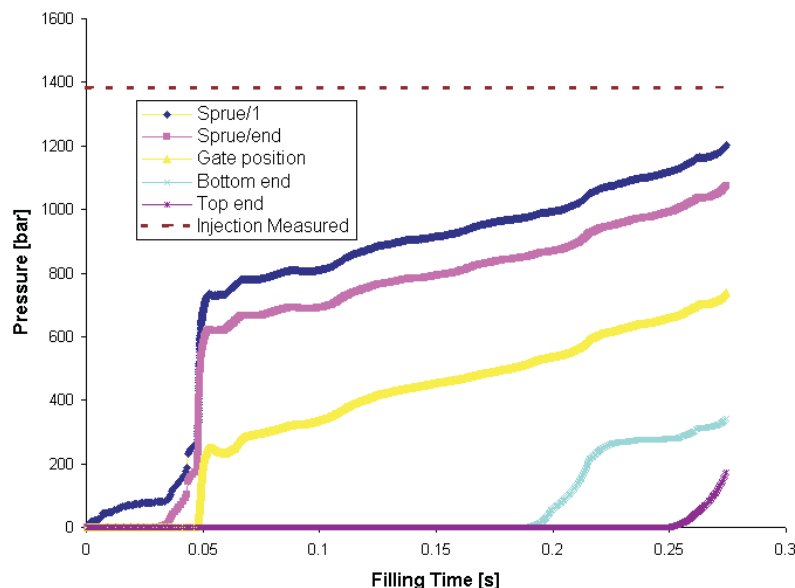

Filling phase of cellular phone cover with LDPEH1840 by BASF only for testing purposes. Similar way simulation forecasts right end pressures with true compounds. Pressure drop ∆P between Inj. Measured and Sprue is abt. 150bar.

Summarized

Polymer melt flows at different states can be ruled by three constants, namely temperatures by α pressures by β and viscosity transitions during pressure by φ values.

$$\eta(\dot{\gamma},T,P,t)=\langle\alpha,\beta,\varphi\rangle$$

The nature, structure and function of DataPower Server differs a lot from CAE software. Thus TCP/IP connection is a novel solution to join these different worlds.
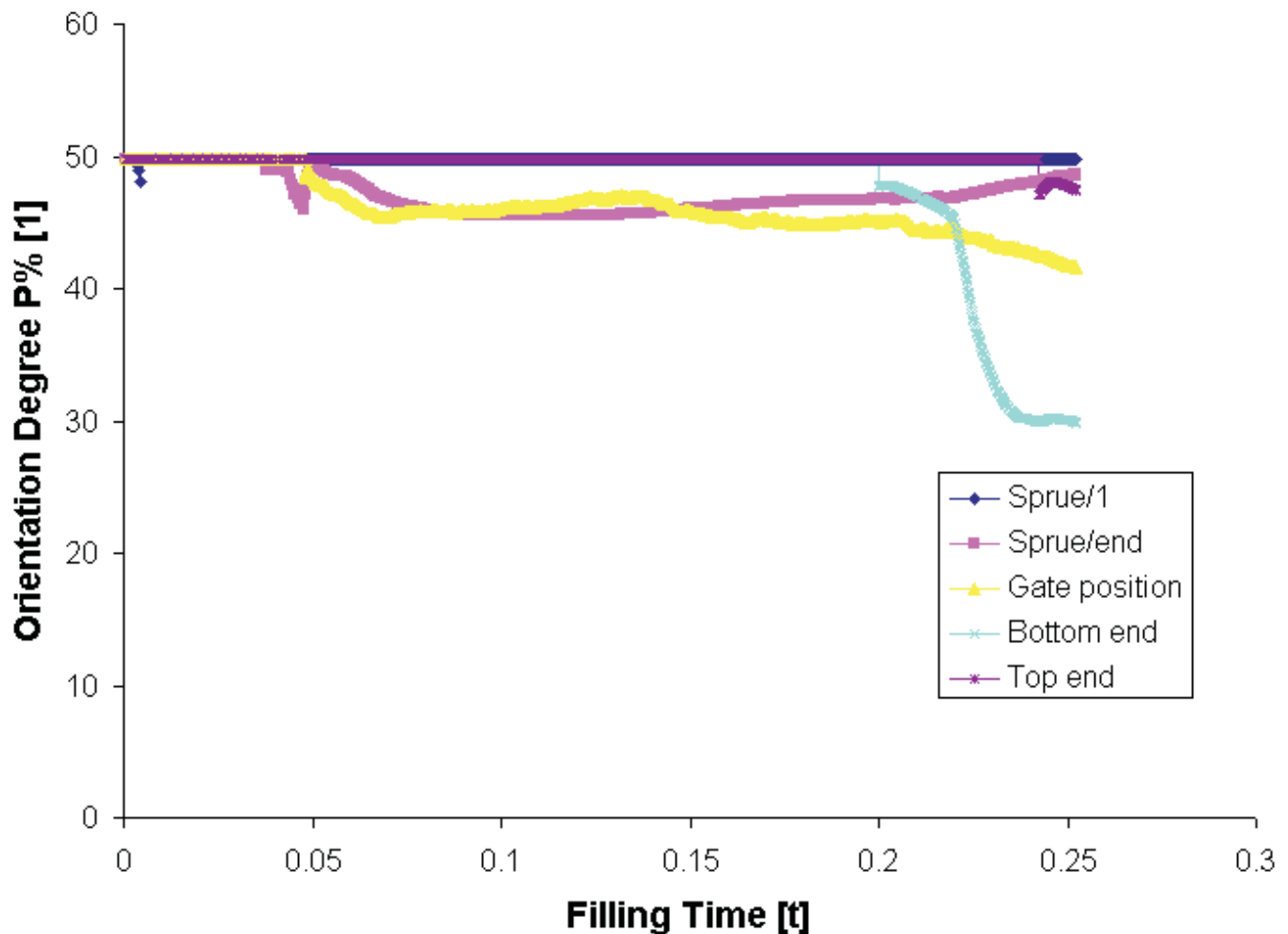
Orientation degree P% at some points of cavity during filling phase. Figure shows that high orientation degree still remains before packing phase. Results can be colleted to similar type 3D chart as pressure is presented.

Performance of DataPower Server

- *In the same computer 420 data services in a second means average response time of 2.4ms.*
- *In the Intranet connection 100 data services in a second means average response time of 10ms.*
- *In the Internet connection 10 data services in a second means average response time of 100 ms.*

System Requirements for DataPower Server:

- Intel Pentium or faster.
- Windows 95/98, NT 4.0, 2000, Millenium or XP.

System Requirements for CAE Client:

- Can use TCP/IP protocol: Client: $(t, P, T, \dot{\gamma}, P\%)$=> Server: $(P\%, \eta)$.
- The function calls for DLL is added.
- For multi elements mode is needed DataPower Premium license.

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RheoPower and DataPower Software packages for Polymerization, Extrusion and Injection Moulding business.

Version 1.1e