
The OnLine Rheometer Group of Rheology Solutions Pty Ltd, has brought to the world market the first OnLine Rheometer (OLR) to continuously measure, plot and report the flow properties of process liquids in the pipe. The OLR is for process monitoring, process control and quality control of liquids in the process and manufacturing of cosmetic and personal care products, food, chemical and household cleaning products.

The OLR is used to measure the micro-structure of the liquid in the pipe, and relay this information to the factory operator either through SOLR - the Software for the OLR or through the factory Process Logic Controller (PLC). In this way the operator can make a decision about whether the liquid is within specification and proceed to the next process step, or take corrective action as appropriate. The OLR will provide instant and accurate rheological data in real time so that liquids during manufacturing and processing are produced and maintained within specification.

The OLR uses oscillatory squeeze-flow technique - it measures complex viscosity, storage and loss moduli by imposing a small cyclic deformation on a liquid sample at a variety of frequencies, from 1 - 100 Hz. The OLR is used in conjunction with custom developed software specific for the sensor system - SOLR which provides flexibility - the user can determine from the drop down menu what they want to continuously measure, plot and report.

There are three key functions of SOLR:
1. Set-up process monitoring and quality control parameters to monitor the process continuously and provide informed decisions about the process and product trends.
2. Monitoring and control of process either through SOLR or through the factory PLC with the provision of a pass/fail display on screen plus audio or visual alarms if required.
3. Out-of-specification product diagnosis allows the plant engineer to compare the out-of-specification material with in-specification data and diagnose why there is a change in the product quality.

The OLR Advantages:
• Fast and reliable real time results
• Low maintenance
• Out-of-specification diagnosis
• Plug-and-play installation
• Precise and robust sensor system
• Process control
• Process monitoring
• Quality control
• State of the art technology
• Time and cost savings

The OLR measures the viscoelastic properties of a process fluid in real time and will improve product quality and reduce wastage and save time, therefore reducing processing costs.

For more information visit www.onlinerheometer.com
Rheology Solutions is aware that their customers like to receive RheoTalk as a printed newsletter so they can review it over time and share it with their colleagues. Rheology Solutions is conscious of the importance of minimising the impact on the environment through printing and has decided to take the following steps from January 2013 towards reducing their impact by:

- **Producing RheoTalk twice a year** - this will mean that organisations and companies will have six months to review and read the newsletter and plan for their current product purchases as well as plan for their next years budget spend.

RheoTalk will continue to provide current and new information across all industries and applications.

The issues will be produced and distributed for January - June and July - December.

- **Providing Industry Specific Updates as PDFs** - in between the two RheoTalk issues Rheology Solutions will provide an electronic update and summary of the products, application articles and special offers that are available to the seven industry classifications as follows:
  - Chemical & allied industries
  - Construction & building industries
  - Food industries
  - Mining industries
  - Pharma, cosmetic & allied industries
  - Polymer industries
  - Surface coatings industries

RheoTalk goes Bi-Annual

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Application Articles

Comparison of Drying Operations on the Rheological Properties of Derivatised Whey Protein Thickening Ingredients

An existing procedure for the alteration of whey proteins into a cold-set thickening agent was modified by developing a spray drying operation to replace the cost prohibitive freeze-drying step.

The original and modified derivatisation procedures were applied to a commercial whey protein concentrate (WPC). The freeze-dried and spray-dried derivatised WPC powders, along with pre-gelatinized starch, xanthan gum, and carrageenan, were reconstituted in water and evaluated through a range of rheological studies. The effects of temperature, concentration, and shear on viscosity as well as the mechanical spectra and the Cox-Merz rule were assessed to characterise the ability of the powders to function in food systems. The rheological characterisation revealed the modified derivational procedure yielded an ingredient capable of cold-set thickening and gelling ability over a wide array of environments similar to the original derivatised powder. The modified whey proteins were also able to achieve, at higher usage levels, textural properties similar to several polysaccharide thickeners. Incorporation of spray drying created a more economical process for the production of a whey protein ingredient suitable for contributing viscosity and texture to a wide range of food systems.

A copy of this application note is available by quoting RF-180902-US-01

Application Paper

Slurry Rheology and Pipeline Transport Properties

Slurry transport in the mining industry is a commonly used technique for moving partially and fully process materials, and waste. Efficient slurry transport poses serious engineering problems through the properties of the slurry. These include, but are not limited to, particle settling, attrition, pipe/fitting/impeller wear, degradation of flocculated or friable solids, and the pumpability of the slurry.

In-transit particle settling leads to stratified flow, which in turn can cause uneven and excessive wear in the transport system, and in extreme cases, pipeline blockage due to solids build-up around fittings or inclined sections. Particle attrition has several drawbacks. Firstly, the product before the pump and pipe is not identical to that afterwards if the particles are friable. Secondly, changes in particle size distribution may affect the ability of the particles to remain suspended in the carrier fluid.

Rheological techniques can be used to design for and manipulate processes. Rheometers and viscometers allow engineers to measure and assess the causes and effects listed. High precision equipment is available for repeatable and reliable measurement of flow properties and robust units for the field use are also available. These units have value for both QC and product development.

A copy of this paper is available by quoting Rheo013 TP

Application Articles

Solvent Trap and Double Cone System for Reproducible Results in Rheological Measurements of Low Viscous Volatile Fluids

Rheological measurements of low viscous volatile fluids require the control of the surrounding atmosphere of the measuring gap. The solvent trap creates a defined atmosphere around the measuring gap and the unique HAAKE double cone system provides a sealed system for low viscous samples.

Low viscous water-based glues are a good example for volatile low viscous fluids. In order to get good measuring results in the low shear regime a controlled stress (CS) Rheometer (HAAKE RheoStress 600) was used. To show the advantage of the solvent trap and the unique HAAKE double cone system, measurements were performed with and without solvent trap and double cone system.

A copy of this application note is available by quoting V229
Application Articles

Measurement of Ceramic Slurry for Porcelain, Ceramic Tiles and Sanitary Industries

To monitor a ceramic slurry for control purposes, a ViscoScope® viscosity analyser was mounted in the pipeline leading to the mould filling stations. The ViscoScope® sensor was mounted vertically downwards with flow vertically up, to prevent particulate to settle onto the sensor shaft and flange. This way reliability and reproducibility was assured.

The ViscoScope® viscosity analyser measures the viscosity with a torsionally oscillating sensor. The generated amplitude is very small, the energy input into the slurry does not disturb the fragile molecular bonds.

One company has the ViscoScope® to monitor the thixotropic behaviour of ceramic slurry. This was accomplished by stopping the flow of the slurry for a fixed amount of time and monitoring the rise of the viscosity during that period. This can only be accomplished, because the measurement does not have any impact on the fluid.

Continuous analysis of the viscosity and viscoelastic properties replaced the costly method of periodic off-line sampling. Initially many laboratory measurements were made to compare the methods. The correlation achieved was proofed to be better than 99%.

The continuous viscosity information enabled improvement of important parameters like filling speed, homogeneous cement composition and the settling time of the ceramic slurry in the mould. This resulted in a return of investment in less than 3 months!

A copy of this application note is available by quoting MX-002

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Application Articles

Curing of an Acrylate Glue - Rheology with Simultaneous FTIR-Spectroscopy

Everybody who has ever worked with glues knows that timing is one of the crucial issues. Subsequently technical leaflets for glues sometimes look like timetables. Terms like pot life, open time, time for minor adjustments, curing time or time to reach maximum bonding strength, are used to describe the properties of glues and to give guidance for their successful application.

For the development of new glues all these times have to fit the application to create a product the market targeted will accept. For example, depending on the method to apply the glue the open time needs to be adjusted to avoid curing before the parts have been joined.

A rheometer is an essential tool to characterise not only the uncured glue but especially the curing process itself. No matter if a drying glue, a curing glue, or an UV-curing glue is investigated, due to their wide range of accessories the Thermo Scientific HAAKE MARS or the Thermo Scientific HAAKE RheoStress rheometers are the perfect tools to characterise its curing behaviour. Still, the classical limitation of rheological methods remains: a Rheometer can only tell us what happens during the curing but it does not tell us why. The "why" becomes especially important when we want to understand why a batch of the glue shows other properties than the expected ones or when we want to develop glue for a new application. To overcome this limitation, the rheological data needs to be combined with data from another analytical method able to detect what happens on the molecular scale. A perfect match is the FTIR spectroscopy, a method, which is able to identify and quantify different chemical groups in a substance or in a mixture of substances.

The disadvantage of running tests on two separate instruments is the extra effort it takes to prepare two different samples following different procedures for each method. Plus, as a consequence, this approach makes it virtually impossible to collect both sets of data on two identical samples under exactly the same conditions.

To combine rheological tests with FTIR-spectroscopy avoiding the aforementioned disadvantages, the Rheonaut module has been developed, a unique combination of a temperature control module for the HAAKE MARS rheometer and an Attenuated Total Reflection (ATR) cell with its own IR detector. With the Rheonaut module the HAAKE MARS can be combined with an FTIR spectrometer to one analytical setup (Fig. 1). Only with this unique combination it is possible to record the mechanical changes of the curing glue while at the same time and, even more important, on the same sample IR spectra can be collected to track the chemical changes inside the sample.

A copy of this application note is available by quoting V-254
Rheological Analysis of the Stability of Pharmaceutical Suspensions

In addition to the actual medicinal components, often only present in milligram amounts, a drug contains a number of additives which give the preparation its required form, e.g. tablets, solution, gel, emulsion.

Many pharmaceutical products are produced in the form of a suspension. Well known examples are antacid which contain magnesium and aluminium hydroxide, sugar substitutes such as Sorbit and Mannit, as well as preserving agents (parabens).

Suspensions are usually dispensed in bottles or sachets and are taken orally. The rheological properties of both liquid and semi-solid pharmaceutical products are important for the bottling process (e.g., pumps, dispensers) and for the selection of suitable packaging. For example, a nasal spray needs to demonstrate a certain viscosity so that the active ingredient can be applied via a spray.

Similarly, all products that are administered by drops (e.g., Eye drops, ear drops), must be dispensed slowly under the effect of gravity.

The storage and transportability of suspensions must also be considered. Settling of solid particles is not usually desirable. Even without shaking the container prior to use, the solid particles should be evenly distributed throughout the liquid and remain suspended. Stabilisers are thus added to a medicine in the form of polymers to give the product its required properties.

Extensive testing, including shaking products and exposing them to temperature extremes, determines if newly developed medicines are stable or unstable.

A copy of this application note is available by quoting V-154

Cryopreservation of Mammalian Oocytes and Embryos

Cryopreservation of bovine embryos has become a standard method of commercial embryo transfer. The process requires a transportable unit that offers all the advantages of a large-scale, high-performance laboratory cryostat used for research purposes. Thermo offers several cryostats that are ideal for this application.

The Process Embryos (preferably morulae or blastocysts) are packed in paillettes and submerged in the -4 to -6°C cooling bath of the temperature control unit. After 5 minutes, seeding is initiated by touching the paillettes with tweezers cooled in liquid nitrogen. After another 5 minutes, the embryos are cooled gradually to an insertion temperature of -32°C. A cool-down rate of 0.3°C/min is achieved via a programmable controller. After reaching -32°C, the paillettes are plunged directly into liquid nitrogen to ensure the fastest possible chilling.

The process has long been established as a common method for deep freezing laboratory animal embryos. In recent years, it has been used in the field with great success for the cryopreservation of bovine embryos. Further modifications have led to the use of cryopreservation for deep-freezing equine embryos as well as the unfertilized embryos of mice and rabbits. These more sensitive samples are packed in paillettes and placed in the cooling bath at +15°C.

After 5 minutes the samples are cooled down to -6°C at a cooling rate of 1°C/min. The remaining steps in the cryopreservation process are identical to those described earlier.

A copy of this application note is available by quoting TC05-3

Influence of the Incorporation Sequence of Different Components on the Energy Consumption of the Mixing Process with the HAAKE PolyLab QC

In a production process it is of major interest to reduce energy consumption by optimising the mixing process. The following example shows how a laboratory mixer can be used to optimise the incorporation sequence of different components of a mixing process.

A comparison of the energy curves of the two test shows that the energy consumption of procedure 1 was about 40% higher than the energy consumption of procedure 2. For the production process this means that the incorporation sequence of procedure 2 would save a significant amount of energy compared to procedure 1.

A copy of this application note is available by quoting LR-65
Time-Temperature Studies of Gellan Polysaccharide Gelation in the Presence of High Levels of Co-Solutes

Thermorheological scanning, time-temperature superposition (TTS), and modified Cole-Cole (MCC) analyses are sensitive indicators of temperature-dependent morphological changes during gelation. In the present study, the gelation of gellan polysaccharide in the presence of high levels of co-solutes (sucrose and corn syrup) was studied using thermorheological scans, TTS, and MCC analyses. Thermorheological scans at 0.15 Hz and isothermal oscillatory frequency scans between 0.15 and 15 Hz were performed over a temperature range of 5-85°C. Thermal scans during cooling showed a rise in the magnitude of viscoelastic parameters (storage modulus (G'); loss modulus (G'')) as co-solute concentrations were raised from 77.5 to 85% w/w. Upon cooling from 85-5°C and then re-heating, samples were thermally reversible up to about 60°C, above which a significant rise in G' was evident. The temperature at which “structure re-building” initiated increased with added co-solutes. Isothermal oscillatory frequency scans were performed at co-solute levels of 80 and 85% w/w. With the exception of scans corresponding to the “structure re-building” event, successful superposition of isothermal frequency curves was achieved with both the TTS and MCC analyses. Failure to superpose data during “structure re-building” suggests that temperature dependent relaxation mechanisms associated with macrostructural changes occurred within the material. It is hypothesized that the gellan forms “gel particulates” or “gel islands” embedded within the co-solute matrix, rather than a continuous network.

A copy of this application note is available by quoting RF-190902-CA-01

Production of a Blend of Two Different Concentrations by a Parallel Double Screw Extruder and a Further Processing Through a Melt Pump and Following Measurement of the Rheological Characteristics in Slot and Rod Capillary Dies

Plastic melts and melts of blends are non-Newtonian, but viscoelastic liquids, which means their flow behaviour is to a high degree dependent on the shear rate that affects them. Generally such melts show intrinsically viscous behaviour, where the viscosity decreases at increasing shear rate and the elastic characteristics become more evident.

The aim of this test was the production of different blends in a parallel double screw extruder and their rheological characterisation in a capillary die. In the process the shear rate was regulated by conducting the material through a melt pump whose speed was variable, and the shear stress was measured. In addition this technology should be used to compare the blends with the original components of the blends.

A copy of this application note is available by quoting LR-38

Image: Slot and Rod Capillary Die
Materials processing for the construction industries include operational steps such as mixing, pumping, compression, injection and cure.

Specifically for the construction industries, materials characterisation is of critical importance (including liquid-related issues like sedimentation, time related structural decay or build-up and post-cure issues like strength in compression or extension) for prediction and management of the pourability, cure rate, dimensions, strength etc of different construction solid and liquid materials. These processes depend on fluid rheological parameters such as viscosity, viscoelasticity, creep and recovery, and solid material properties such as behaviour under various compressive and extensional loading conditions.

The Rheology Solutions applications laboratory has state of the art equipment, capable of measuring many of the above parameters, and of providing interpretation of the results where necessary. Laboratory equipment includes highly sensitive, specialised, modern instrumentation and sensor systems, for measuring complex or difficult fluids such as those with very low viscosity, or those with a highly settling solid phase, or liquids with significant extensional or viscoelastic properties.

Information such as shear viscosity curves, thixotropic behaviour and flow curves may be obtained for interested clients. Additionally, of importance to the industry, when scientifically assessing changes in flow behaviour due to temporal or ingredient issues, viscoelastic moduli as a function of temperature, shear stress or strain can be assessed. Structural changes under very low shear (like in the case of storage, gravity settling, compression moulding etc) or very high shear (pumping, mixing, injection moulding etc) are possible using the advanced equipment and sensors available at the laboratory of Rheology Solutions. These measurements may be obtained as a function of temperature, solids density, or to monitor the effects of changes in additive/ingredient species or concentration.

With this information the scientist or engineer may change the process, or design new unit operations or products to maximise the potential benefits to be obtained from the physical properties of the processed fluid.

**News & Views**

**Materials Testing for Construction Industries**

**Conference Focus**
22nd Conference “Rheology of Building Materials”, Regensburg, Germany
March, 06-07, 2013

The 22nd conference on the Rheology of Building Materials will take place between the 6th and 7th of March, 2013 in Regensburg Germany at the University of Applied Science.

Several papers will be presented about the measurement and control of the flow properties of mortar, fresh concrete, UHPC, SCC, steel fibre reinforced concrete and similar materials.

All conference slide presentations will be in English and the presentations will be in English or German.

**Proceedings**
All conference proceedings as provided by the presenters - authors will be published and available on www.schleibinger.com

**Program**
- Wolfram Schmidt, BAM Bundesanstalt für Material und Prüfung, Berlin, Germany. “A simple experimental method to determine the qualitative influence of any PCE superplastisiser on the rheology”
- Florian Fleischmann, Hochschule Regensburg, Germany RheoCT, “Measuring and controlling the workability of SCC in the concrete plant mixer”
- Professor Dr. R. Vogel, R. Vogel Forschung, Weimar, Germany “About the sedimentation of sphere shaped particles in fluids with a yield stress. A critical literature review and some supplementary experiments - will be actualised”

**Attendance Fees**
The conference and the workshop including the conference lunch is free. Hotel, evening dinner etc. must be covered by the participants.

**Registration for 2013**
Please send an e-mail with your name and complete address to anmeldung@schleibinger.com and they will confirm your registration by e-mail.

Further information can be found on the Schleibinger website at www.schleibinger.com
FAQ 1: What is melt extrusion?

The melt extrusion process is becoming more established in the pharmaceutical industry due to its ability to improve the limited bioavailability of “challenging” drugs during the formulation stage. Furthermore, the melt extrusion process is operated in continuous mode and can be equipped with online analytical monitoring, saving cost in the production of drug dosage forms.

In just a few minutes, a sample can be obtained from raw materials. This sample can either be the final dosage form or at least a granular form that can be further processed into tablets or any other required form. All this can be done without using solvents. Modern melt-extrusion formulation approaches show that the process is also suitable for heat sensitive molecules as well as for shear sensitive molecules.

FAQ 2: How can I ensure the content uniformity of my active pharmaceutical ingredient?

The most important tools for ensuring content uniformity are feeders. The commonly used method is split-feeding which means that each component is fed by a separate gravimetric feeder. These modern feeders can control the feeding by measuring the loss in weight continuously over time. The feeders can be calibrated for the material you are going to feed. During this process, the feeder learns about the flowing characteristics of the material.

Did you know that you can not only feed solids, but also liquids and pasty substances into the extruder? The feeding site in the extruder can be chosen depending on your formulation needs. For labile substances, feeding at a very late stage of the extruder is possible by e.g. slide feeding.

FAQ 4: What is our recommendation in terms of a direct up-scaling from a small-scale to a production-scale cGMP?

The purpose of the up-scaling process is to transfer the manufacturing of your formulation from a small-scale to a large-scale device. Process as well as formulation aspects have to be taken into consideration. Due to this, there is no general recommendation possible, each up-scaling process has to be worked out depending on formulation. The Thermo Scientific HAAKE MiniLab micro-compounder is designed to ensure an easy up-scaling.

During up-scaling, it is important to keep key parameters such as viscosity, energy input etc. in mind and also look for formulation parameters like dissolution behavior and impurity profile of your formulation. Depending on the chosen excipient and the chemical characteristics, the process parameters can play a major role or minor role in the formation of a solid solution. This is especially important for up-scaling from HAAKE MiniLab to Thermo Scientific Pharma 16 HME Hot Melt Extruder since the HAAKE MiniLab is equipped with conical screws and the Pharma 16 HME with parallel screws.

FAQ 5: I have bubbles in my extrudate. Do they matter and where do they come from?

We assume here that the target was not to obtain a foam by adding foaming agents to the formulation and so the answer to the first question is: Yes, bubbles matter, because they can lead to a different mechanical characteristics of the extrudate as well as bubbles could mean the result of an non-optimised process as it will be discussed below.

Where do they come from? This can have different causes.

- With feeding in materials, air was pulled in and could not leave in the feeding zone. This can happen with micronised materials especially if the material tends to stick. Also if liquids are fed in and some gases are dissolved in the liquid these gases could be released in the extruder. As long as oxygen or other gases does not mean a harm to the formulations ingredients, this is no problem and can be overcome by optimisation of feeding zone and/or by opening the venting port.

- If a component of the formulation is hygroscopic and it is fed non-conditioned (i.e. dry air) or in pre-dried condition, this absorbed moisture can be released at temperatures above boiling point as vapour which form the bubbles in the extrudate then. Since liquids like e.g. water acts as plasticiser they can be a problem if included uncontrolled or not-considered in the formulation. If a substance in your formulation would be unstable in humid condition this moisture would mean a problem. The problem can be avoided by opening the venting port to remove the water steam and by using dry products. In general it is important to not expose hygroscopic components to high moisture.

- Bubbles could mean a degradation of one or more components. If decomposition occurs by unfavorable process conditions you need to optimise your process. With the melt extrusion process it is possible to have very gentle conditions which allows to handle even heat-sensitive substances. If decomposition of a component is caused by chemical incompatibility or by a chemical reaction with another component you need to optimise the formulation.
FAQ 6: How can an API be stabilised in the amorphous state for the complete shelf-life period of a drug?

Many drug molecules are not stable in the amorphous state because they tend to recrystallize or they chemically decompose over time or react with other ingredients. Therefore the amorphous state is not recommended at all. Developing a solid dispersion, the amorphous suspension where drug and polymer both are amorphous but are in two different phase is not preferable. Amorphous systems are meta-stable and are underlying a permanent change. Stability over shelf-life of the formulation would have to be defined as what change is acceptable over the desired time.

Preferable would be to stay with the drug-in-polymer concentration below the saturation concentration to obtain a molecular dispersed system, where the drug can be stabilised by formation of e.g. hydrogen bonds between polymer and drug. Such glassy solid solutions can be long-term stable if they are treated with factors like moisture. A solid solution is a thermodynamic stable system but it has to be recognised that the true solubility of a drug in polymer is also limited.

The other option to obtain a stable solid dispersion is to leave the drug in a crystalline state, but generate very small crystals to have an improvement in solubility of the drug by a dramatic increased specific surface. Which method is working better has to be determined for each drug separately.

FAQ 7: Is the material already well mixed right after it is put into the extruder?

Actually, the extruder is an excellent mixer. The material will be inside the extruder distributed and the material also will be dispersed. The mixing conditions inside the extruder make it more independent from the particle size of the fed-in materials. But the mixing may take a moment inside the extruder so it will have to pass two or more zones, also depending on the chosen screw configuration and the temperature (for softening or melting components).

By the way: Theoretically a pre-blend can segregate after leaving the feeder falling down the way to the extruder if the particle size as an example is different of the components. Inside the extruder this will be homogenised again, so that this means for the practice no issue.

FAQ 8: How do you control the constant feeding from the Hopper?

To ensure a constant feeding rate, a few pre-requisites have to be ensured:
1. Good flowing characteristics of the material which need to be fed.
2. Homogenous particle size if fed as pre-blend feeders can be operated in a volumetric mode and in a gravimetric mode. Thermo Fisher is recommending the gravimetric mode. In the volumetric mode the feeder speed will be kept constant but a real constant material flow is only achieved with excellent flowing characteristics of the material that do not change over time. In the gravimetric mode the feeder is permanently monitoring the loss in weight over time and can adjust the feeder speed permanently to ensure a constant mass flow.
Metal injection moulding (MIM) is an established process for production of metal parts in commodity and industrial products. The process leads to a certain amount of sprue, which is more significant the smaller the parts are. To increase the cost efficiency of the overall process the sprue is recycled and blended to virgin feedstock as reground material.

In order not to compromise the mechanical properties of moulded parts from this recycled feedstock, it is necessary not to exceed a maximum amount of recycled MIM feedstock. Learn how you can determine the optimal ratio of reground sprue and virgin feedstock for your process by using a Thermo Scientific HAAKE PolyLab torque rheometer system performing a mixer test.

Further information is available in an Application Report - Mixer tests on MIM feedstock sprue to determine the optimum mixture of the injection moulding process.

A copy of the application report is available by quoting LR69.

When using Hot Melt Extrusion (HME), the segmented screw design of parallel twin-screw extruders is a key benefit, especially when designing an appropriate process configuration for a given pharmaceutical formulation.

To suit various applications the screw elements offered are manufactured from various materials. For pharmaceutical or food applications, screw elements are manufactured from surgical grade steel. For increased wear resistance elements are offered manufactured from powder metallocurgical alloy (CPM).

The knowledge of the processing properties of the different screw elements is a key factor for success.

Learn more about the flexibility of the screw elements available for the Thermo Scientific pharmaceutical twin-screw extruders and how the distinct elements properties influence your process.

A copy of this product report is available on request by quoting PP-016.

Designed to minimise material costs, be very easy to operate and optimise laboratory space, the new Thermo Scientific Process 11 parallel Twin Screw extruder offers research scientists a whole new world of possibilities. The Process 11 features a throughput of 20 g/h to 2.5 kg/h and a segmented screw design with removable top half barrel. The screw elements and barrel design scale geometrically across the whole suite of Thermo Scientific extruders and thus allow easy process scale-up.

A copy of this data sheet is available on request by quoting Process II.
“Live” Quality Control

Film Inspection. An integrated inspection system concept for plastic film production makes it possible for process and quality analysis to be carried out at different workplaces by various responsible personnel. SPC visualisation directly on the machine via the inspection systems opens up great potential for handling quality and process information.

Written by Andreas Schnabel and Oliver Hessmann

Originally published in Kunststoffe International 4/2012

Film inspection systems are increasingly becoming an essential part of film production lines. This is because, firstly, the market demands 100% quality control for pharmaceutical, medical-grade or food-grade films and, secondly, all film manufacturers want to avoid an excessive reject rate and continuously optimise their entire production process. In view of the high investment costs for a film production line and the constantly rising material and energy costs, film manufacturers require objective information about actual film quality and the optimisation potential of their process from the raw material to packaging.

Teach-in Technology

Many manufacturers of high-quality films monitor virtually 100% of their production with modern film inspection systems. These are able to detect the slightest defect, mark it, and trigger an alarm or inform the machine operator or person responsible for the process immediately. Here, the process itself, the raw material and the end product are monitored.

With the rapid advance in technology, modern inspection systems have a data rate of up to 320MHz per camera. Depending on the application, CCD line-scan cameras with 2,048, 4,096, 6,144 or 8,192 pixels are used, as well as color line-scan cameras with CMOS sensors to detect low-contrast color defects. These achieve scan rates of up to 144kHz. So even with very fast web speeds, high resolution can be obtained in the web travel direction (Figure 1).

Today’s systems detect surface defects such as specs/gel particles, burn marks/black specs, fisheyes, coating cracks, streaks, flow lines, or insects. With the aid of defect images, the operator can teach in the defects and the system will then automatically specify the classification criteria for the defect categories.

Via different interfaces, data from external sensors or other measuring systems can be processed in the inspection systems. It is possible, for example, to read in laboratory color space values, degrees of gloss or thickness values. These are then integrated with the established definition and visualisation variant and then visualised as own data. Consequently, alarms can also be set for deviations from this external data.

Fully Integrated Concept

The road to achieving a fully integrated concept for inspection systems (“live” quality control) is a long one. In the steel, paper and polymer industries, different quality concepts have already been fully standardised internally but differ greatly from company to company.

Full integration means not only capturing inspection data from one or more measuring systems but also combining it with plant and process data (PLC), material data (SAP) and order data (BDE). Normally, this data is archived in higher-level, often independent, database systems and visualised on the plants with SPC analysis tools. Analysis of quality variations and their correlation with material and process data is only possible later or with other software packages.

The latest possibilities offered by inline inspection systems include not only the usual visualisation of detected defects and assessment of film quality but also extended data logging, data visualisation at separate workplaces, and parallel or subsequent data analysis with different configurations or time intervals.

In order to use the captured quality data in downstream processing operations on machines such as tenter frames, roll cutters or coating units, an overall concept is needed for linking all the existing data and accessing this data at different locations with different functionalities.

Working closely together, OCS, Witten, Germany, and Klöckner Pentaplast GmbH, Montabaur, Germany, have devoted the last few months to discussing possible concepts for extending the scope of inspection systems, and then planning and integrating these additions so that in the near future inspection system data can be used in a better, fully integrated way.

For this purpose, in addition to ongoing joint software development, new tools have been implemented to carry out data archiving, parallel data visualisation, implementation of process and material data, extended data analysis, and SPC visualisation (Figure 2).

Because of the quantity of data captured and the need for long-term storage of this data, data archiving is an important basis for an integrated concept such as this. The inspection systems, which - depending on the size of the company - integrate 5, 10 or 20 production lines, generate a data quantity of several Gbytes per day per line. This data is stored on the respective servers of the measuring systems. To avoid data loss during archiving, a separate tool also works constantly on storing and compressing data from the individual systems onto a central secure data
This process documents on a database when and from which line data has been copied and compressed or has later been deleted on the line server. This database and software also make all roll data from all lines separately available via an internal ID and enable the data to be decompressed and its processing recorded (Figure 3).

Through this data archiving, it is now possible to access and view the measured production quality characteristics of a roll that is currently being processed or is to be processed later on different machines and at different workplaces. The relevant operator can view individual areas or special defects and analyse and define the position of these.

At a later stage, when specifying the further use of the roll (entering how many customer rolls (reels) are required or how much edge trimming is needed for this roll), further defect classification can be carried out and the prepared rolls/reels with defective areas can be completely segregated and separately checked. In this way, unnecessary cutting can be avoided and the customer roll preparation process optimised long-term.

For process technologists or personnel responsible for products, this facilitates the search for certain rolls or production periods, because they can track the produced quality at their workplace at any time with the aid of these tools.

The machine, process and material data also stored in the measurement file during inspection open up further new opportunities for better tracking and long-term optimisation of the production process. This data generated on the production line (via OPC servers or databases) is simultaneously linked to the measured inspection data in precise sequence and backed up via the archiving tool.

During production, inspection and process data can be displayed in parallel or together as trend curves or correlated with each other afterwards as part of process analyses.

To provide the familiar operator interface and visualisation during the production process, another tool is used here that can display specific process and inspection data curves in self-defined trend graphs. This tool is enhanced with SPC functionality so that operators at the machine and personnel responsible for the process and product can directly assess the current quality and process status at their work stations.

By integrating all available data into the existing inspection systems on all production lines, new...
tools are created, which open up a fully integrated concept for inspection systems. Through use or display of the required data combinations of the various tools independently of the machine or workplace, far more process steps can be supplied with data and more employees can be given the specific information they require.

Integration into the Production Plant

Klöckner Pentaplast is giving high priority to driving this process steadily forward and taking an integrated quality approach even further. On the existing calenders and extruders (Figure 4), films made from UPVC, PET and various combinations of other polymers are produced.

All production lines are equipped with inspection systems and for the most part also with labelers. Such systems have for many years been a firm part of quality assessment and process optimisation. In recent years, much work has been done together with OCS on optimising hardware and software and testing various illumination technologies. The level of inspection reached today is high so that in recent months it has been possible to concentrate on designing and developing further helpful program structures and procedures for dealing with the available inspection data.

The camera and defect detection systems installed on the calenders and extruders, which have been described in previous articles, are an important aid to monitoring the quality of the films produced, complying with customer specifications, and process monitoring and optimisation [1, 2]. The systems facilitate rapid intervention in the event of material variations, help to optimise film quality on the calender through adjustment of the many influencing parameters, and are also used to assess different known materials or test new raw materials. At the same time, the systems are indispensable for checking compliance with customer specifications, triggering alarms in the event of any deviations and marking such deviations. If quality variations occur as a result of raw material problems or production faults, these areas must be visualised to the plant operator and the appropriate areas of film marked.

The stored camera configurations form the customer specifications for the respective film types. Within the stored roll data, the taught-in defect classifications and specifications are retained. As well as the defect labels, alarm logs and if necessary roll photos are printed out and attached to the relevant roll. On the roll cutter, defective areas are assessed using the logs and labels and cut out individually or in grouped areas and documented.

The inspection data remains archived on the inspection system server for a defined time period and is stored in parallel on a data server.

The Quality Control department keeps its eye on all production lines via special software. Viewer software receives a screenshot of the measuring system’s defect spreadsheet on a computer in Quality Control. The software enables up to four defect spreadsheets to be displayed on a screen. In this way, Quality Control is always informed about the quality status of the films being produced and can react accordingly.

A central Measuring Technology department can connect to all machines and systems via remote software. This allows it at any time to adapt or copy all configurations at other sites worldwide. Because of the high integration density, once the inspection configurations have been set up, they are used worldwide. So the end customer benefits from the same guaranteed monitoring and required quality, no matter on which line the film has been produced (Figure 5).

The new developments offer an opportunity to further improve standardisation of quality assessment in global production. A processor can achieve the desired quality in any part of any production site in the world through the standardisation of quality determination and increased integration of quality assessment.

Conclusion

The new tools and functionalities described above permit further and better integration of inspection systems on production lines and downstream units.

Step-by-step implementation and use of the data sets now available on roll cutters or sheeters, process and quality analysis at different workplaces and by different responsible personnel, and future SPC visualisation directly on the machine via the inspection systems all open up great potential for handling quality and process information.

The new developments offer an opportunity to further improve standardisation of quality assessment in global production. A processor can achieve the desired quality in any part of any production site in the world through the standardisation of quality determination and increased integration of quality assessment.

References

2. Gerd Finn, Oliver Hissmann: Uncompromising Eyes, Kunststoffe international 97 (2007) 5, pp. 29-30

The Authors

Dr.-Ing. Andreas Schnabel, born in 1970, is a development engineer at Klöckner Pentaplast GmbH & Co KG, Montabaur. Oliver Hissmann, born in 1970, is a sales manager at OCS Optical Control Systems GmbH, Witzen; hissmann@ocsgmbh.com © Kunststoffe
Why Re-Calibrate?

The accuracy of the electronic components used in all instruments drifts over time.

The effects of time in service as well as environmental conditions add to this drift. As time progresses changes in component values cause greater uncertainty in your measurements. At some point in time, the drift causes the instruments uncertainty to become undefined, meaning the manufacturer can no longer predict the uncertainty and guarantee measurement results. To resolve this issue instruments must be calibrated at regular intervals as defined by the manufacturer.

Calibration is the comparison of an instruments performance to a standard of known accuracy. The result of a calibration may be documentation showing the deviation of a measurement from the known standard or it may also include adjusting the instruments measurement capability to improve accuracy.

The goal of calibration is to quantify and improve the measurement accuracy of your instrument.

The benefits of maintaining properly calibrated equipment include:

- Reduced measurement errors
- Consistency between measurements
- Increases in production yields
- Assurance you are making accurate measurements

Rheology Solutions recommends that you periodically calibrate your hardware to ensure measurement accuracy and to keep your instrument operation in peak precision.

Calibrations

To minimise the cost to our customers, we conduct scheduled annual calibrations interstate, however if you wish your rheometer or viscometer calibrated outside of the set program, please phone or email our Administration Manager, Jackie at jackiew@rheologysolutions.com and she will either organise your HAAKE equipment to be sent to our office or put you on the list for a site visit to coincide with the schedule. All equipment received for calibration will have a 48 hours turnaround from the time it arrives in our office and we will contact you to confirm receipt of equipment and date for return despatch.

Calibration letters have been sent out to those customers that have previously had their HAAKE equipment calibrated by us. We will be in contact in the coming weeks to arrange and finalise your booking.

If you have not received a calibration email from us and require your instrument calibrated, please contact our office to arrange your booking.

Interstate calibration schedule:
- Queensland
  Week commencing 21st January, 2013
- New South Wales
  Week commencing 11th February, 2013
- South Australia & Tasmania by request
- Western Australia
  End of November 2013

Please contact our office to arrange a time.

The pricing for calibrations that are conducted in our office or link in with the scheduled interstate schedule in 2012/2013 are based on Melbourne Metropolitan rates as follows:

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>PRICE</th>
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<tr>
<td>HAAKE RheoScope 1</td>
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<tr>
<td>HAAKE RheoStress 50</td>
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<tr>
<td>HAAKE RheoStress 600</td>
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<tr>
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<tr>
<td>HAAKE RotoVisco 1</td>
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<tr>
<td>HAAKE ViscoTester 550</td>
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**Notes:**
- Melbourne metropolitan customers can have their HAAKE instrument calibrated at any time on site
- Victorian customers (non metropolitan) can arrange for calibration of their instrument at any time or when the next scheduled calibration is due by contacting our office direct
- Prices exclude GST, and any parts required for instrument repairs
- Multiple unit calibrations are priced on a sliding scale if they are serviced at the same time. Prices are available on request

All calibrations are completed by our Service Engineer who is factory trained at the manufacturers. A calibration certificate is provided as verification.

As part of the calibration our Service Engineer will:
- Check and adjust the high sensitive measuring head to plate geometry
- Calibrate all physical measurement parameters according to standards
- Maintain all moveable parts and ensure your rheometer is in its optimal condition

If any parts are required in order to repair any instrument found to be faulty, these will be ordered directly from our suppliers, which can take four - six weeks to arrive. When the parts are on hand the repair can be finalised. We will notify you of timing and request that you please be patient if this is the case.

Quotes for all repairs, spare parts can be obtained from us at any time.

Re-Calibrate Today!

Contact Jackie to arrange for service or calibration
Tel: 03 5367 7477 or Email: at jackiew@rheologysolutions.com or Email: service@rheologysolutions.com
News & Views

Rheology Solutions Website Enhancements

Over the last few months the website has been revamped and we are seeing the benefits of this with increased visits to the website and also more product and technical enquiries.

Enquiries have increased by 45% over the last few months with the most visited product page Thermo Scientific HAAKE MARS, followed very closely by the Contact Us page, then Polymer Testing Instruments and then the HAAKE Temperature Control pages. With over 80% of all pages on the website receiving regular traffic - the Rheology Solutions website appears to appeal to a cross section of customer requirements.

Australian enquiries equal to 1 in every five - with USA leading the website traffic at 38%, followed by Australia at 19% and then UK, Germany at around 10% each and a cross section of countries including Indian, Canada, France, Czech Republic, South Korea and South Africa all regular visitors to the website.

Virtual Tour of the Website and Overview of Enhancements

Log onto www.rheologysolutions.com and you arrive at our home page - from there if you are:

Searching for Information

Searches can be performed using two avenues for any/all information based on key word and/or phases. Any/all information will be displayed including a brief synopsis with the ability to Read More as required.

Searches can be carried out by using the “Quick find” Search box on the front page or the “Search” section from the top menu at any time.

Moving Around the Website

You are now able to move around the website more easily as all links are now highlighted in “Orange” or change to “Orange” as you move over them, allowing you to drill down to more specific information as you go. Your browser’s back button also allows you to move backwards.

If you know what you are looking for you can use the “Quick link” lists at the bottom of every page. These take you quickly to the selected Products, Resources and/or Industry section without going through the Main menu.

Information on Products


Products have been sorted into nine Product Ranges and then sorted by the product manufacturer within each range. This allows you to view all the available products in the Rheometer range for example or in reverse all the product produced by a certain manufacturer. Product Brochures and Specifications are supplied as PDF files and can be viewed online and downloaded for your reference.

Information by Specific Industry

The website has classified and grouped all the information that is specific and or relevant to the following seven key industries: Building & Construction, Chemical & Allied, Food, Minerals, Pharmaceutical & Cosmetic, Polymer, Surface Coatings.

If you are in doubt about the information you are looking for or require an overview of what is available you can locate all the information that is available on our website for a particular industry.

Also included is the range of Information kits for each of the seven industries to assist you with product selection, product applications and problem solving.

Latest Updates

Any/all new information placed on the website is listed under the “Latest Updates” section on the front page and is linked directly to the webpage for easy viewing. This will allow you to keep up to date with all the new Product, Industry, or Resources information.

More Information

Any time you need more information on any of the information on the website, have any requirements that you are unable to find, drop us a line using the “Contact Us” page and we will respond to you within 24 hrs of you making your request.

Future Enhancements

If you have any comments or suggestions on additional information you would like to view or access on our website, drop us a line and we will see what we can do.
Rheology Combined with Spectroscopy

The patented Rheonaut® module for the Thermo Scientific HAAKE MARS rheometer simultaneously measures rheological properties and structural changes on the molecular level using FT-IR spectroscopy. This allows extensive investigations of structural changes under deformation/shear as well as thermally induced or UV-curing. The new level of understanding of rheological phenomena on the molecular level enables researchers to speed up formulation development and process optimisation.

As a “macroscopic” analytical method, Rheology provides information on the bulk behaviour of a sample under specific conditions. However, viscoelastic properties of a material depend on its molecular structure. Coupling an FT-IR spectrometer with a rheometer allows the detection of changes in rheological properties on the molecular level, conformational changes and molecular orientation as a function of shear or due to chemical reactions.

The data sheet provides an overview on the benefits of the combined methods, application examples on the:
- Inter- and intra-molecular interactions for the - stability of emulsions
- network formation of gelatine and - denaturation of proteins
- Extensive rheological investigations on chemical reactions for - thermal and UV-curing

Additionally, a number of application reports are listed that are specific to these industries and applications. These are available from Rheology Solutions by requesting:
- P033 Spectroscopical insight into rheology
- P037 New UV module for UV curing measurements
- V246 Measuring of fast UV curing materials using oscillatory measurements
- V247 Detailed analysis of curing reactions of polyurethane resins
- V254 Curing of an acrylate glue - rheology with simultaneous FTIR-spectroscopy
- V257 Monitoring emulsions morphology under shear
- V258 UV-induced curing reactions

A copy of this data sheet is available by requesting 623-2129 V1

Application Solutions using Extensional Rheology

Complex flows that contain strong extensional flow fields occur in many industrial processes and applications. Some examples are coating flows, fibre spinning, spraying and printing as well as chewing and swallowing. Materials that might behave very similar in steady shear or oscillation can behave completely different in an extensional flow field. Therefore, knowledge of the extensional behaviour is crucial in understanding your fluids behaviour towards a certain application or process. Knowledge you will only be able to gain by working with the Thermo Scientific HAAKE CaBER 1*, the only commercially available Extensional Rheometer for fluids on the market.

The data sheet provides an overview of the principle of operation and provides application solutions for food, petroleum, inks and coatings industries. Additionally it provides reference to four application notes that are specific to the HAAKE CaBER 1.

These are available from Rheology Solutions by requesting:
- V-204 Optimisation of the filling process of shampoo sachets with the HAAKE CaBER 1
- V-206 The influence of thickeners on the application method of automotive coatings and paper coatings - HAAKE CaBER 1
- V-208 Correlation of misting during printing with extensional rheological investigations on offset printing inks with the HAAKE CaBER 1
- V-211 Optimising and forecasting the filling behaviour of coatings with the HAAKE CaBER

A copy of this data sheet is available by requesting 623-2058 V1

*The HAAKE CaBER was developed by Cambridge Polymer Group (CPG) based on the pioneering work of Russian scientists Entov, Rozhkov and co-workers in capillary break-up rheometry.

www.rheologysolutions.com
Customer Case Study - Ensuring Consistent Quality of PVC Compounds

The Challenge

Rigid PVC is used in the construction industry for windows, piping, signs, roofing sheet material and other products. More flexible versions serve as an alternative to rubber and are widely used in the manufacturing of clothing, footwear/boot grades, upholstery, electrical cable compounds and many other everyday products. Vinyl Compounds Ltd formulations range from industry-standard mixes to highly technical and customer-specific formulations such as high-performance weatherability, exact color matching, softness, fire retardant or oil resistance.

To mimic the production process at their customers’ facilities, Vinyl Compounds had, for years, used a simple, single screw extruder. This device was used to melt PVC compound and extrude it through a die, and it did not contain a torque measuring system.

This approach turned out to be insufficient, as modern PVC formulations are very sensitive to process conditions. Uncontrolled process conditions can ultimately compromise quality, consistency and repeatability of the end product at the customer’s site. In order to ensure the highest possible quality for their customers and to be able to process an ever-expanding range of rigid and soft PVC materials, Vinyl Compounds needed to find a modern and versatile extrusion testing solution.

The Solution

Vinyl Compounds Ltd replaced the old single screw extruder with the Thermo Scientific HAAKE Polylab QC torque rheometer system with a 19mm 25:1 L/D single screw extruder. The new equipment solved two problems that the outdated single screw extruder could not address: testing for consistency and developing new compounds.

The HAAKE Polylab QC can relay information such as temperature, torque, viscosity, pressure and texture of the flexible material as it is produced. Using this data, Vinyl Compounds can identify, analyse and, if needed, change variables in the mixing process to eliminate inconsistency.

The HAAKE Polylab QC also assists with developing new formulations, starting with testing small-scale batches and moving up to full production batches, something the old single screw extruder couldn’t do.

The HAAKE PolyLab QC has also helped streamline the PVC compound manufacturing process from beginning to end. By providing customers with batches that meet their exact specifications, the production processes never have to be interrupted or slowed down and customers can consistently produce high-quality products. This commitment to quality preserves brand integrity for Vinyl Compounds Ltd customers, who can confidently deliver a consistent product to their own customers.
Industry Applications

Next Generation Process Viscometers - New and Updated Product Range

The ViscoTron process viscometers from Marimex Industries Corp. Measure the viscosity of liquids continually and precisely in-line.

The measurement system consists of a sensor, transmitter and the transmission cable. Safety barriers are added, if the sensor is being used in a hazardous area.

The sensor has no moving parts and is maintenance free. The viscosity is measured using a constant amplitude torsional oscillation principle. The sensor vibrates at its natural resonant frequency. The power required to maintain the amplitude, is a measure for the viscosity in mPa·s x gr/cm³ (n x p).

Applications for the ViscoTron System cover a wide range of examples and industries as follows:

- Additives
- Bitumen
- Ceramics
- Detergents
- Emulsions
- Food products
- PET production
- PIB extruder
- Polymers
- Printing presses
- Silicone
- Starch
- Low to high viscosity resins
- Paint and coating applications
- Pharmaceutical products

Operating Principle

ViscoTron process viscometers measure the viscosity of liquids continually and precisely in-line. ViscoTron sensors have virtually no moving parts and are maintenance free.

Torsional oscillation viscometers are surface loading devices. These devices measure the viscosity at the interface between the liquid and the solid surface.

The sensor bulb twists back and forth at the sensors natural resonance. The drive shaft is welded to the sensor and the opposing static plane, acts as a spring for the resonance. This completely welded construction hermetically seals the internal mechanism from the process and provides high integrity of the sensor. The vibration on the sensor surface can barely be felt. ViscoTron sensors utilise a constant amplitude torsional oscillation principle to measure the viscosity. The power required to achieve the constant amplitude is a measure for the viscosity. This technology allows for the large range-ability of the ViscoTron systems.

Technology

ViscoScope and ViscoTron transmitters use different technologies.

ViscoScope transmitters are a hybrid transmitter employing analog PID feedback control to maintain a constant amplitude on the sensor surface. The signal is then digitised and used in conjunction with the calibration curve to calculate the viscosity.

ViscoTron transmitters are direct digital drive transmitters and employ a kind of feed forward control to maintain a constant amplitude. A high powered processor enables the use of an algorithm with accurate frequency control, which at the same time follows and controls the sensors behaviour. This technology mitigates influence from external influences like mechanical vibrations or electrical interference at the source instead of masking them with a filter later.

Because the feed forward control signal is digitally generated it can be used to calculate the viscosity directly.

Dependent on the type of sensor and electronics used, the ViscoTron system can be applied in many processes. The total measurement range covered by ViscoScope and ViscoTron systems starts at 0.1 cP and ranges up to 5,000,000 cP. Optionally all sensors can be delivered with ATEX or CSA hazardous area approval.

A copy of the full product brochure on the Marimex range of Process Viscometers is available by quoting V12/03-1.
The VP-3000 sensor has been developed, employing experience gained over many years of sensor design, manufacture and customer experience. These next generation sensors are built for rough process environments. The sensors are orientation independent. Without any moving parts they are maintenance free and rugged. The ViscoTron VP-3000 can be manufactured to match customer application requirements by being able to use any length or shape of extension.

- Ranges from 0.5 to 2,500 all the way to 500 to 2,500,00 mPa·s
- Process pressures up to 500 bar / 7,250 psi
- Process temperatures up to 450°C
- Process connection: According to customer requirements
- 3” 300# ASME and DN80 PN40 standard
- ATEX or CSA approval for hazardous areas

A copy of the product brochure is available on request by quoting V12/03-1

ViscoTron VP-1000 New

The VP-1000 and VP-1000c have been designed for standard applications and yet can be adapted to customer process application and connection requirements. The series ViscoMeter VP-1000 is available in versions capable of measuring low viscosities or high viscosities. With process pressures up to 10 bar / 150 psi and process temperatures up to 130ºC these sensors will fit many applications and can be easily adapted to OEM requirements.

- Ranges from 1.0 to 1,000 all the way to 1000 to 1,000,00 mPa·s
- Process pressures up to 10 bar / 150 psi
- Process temperatures up to 175°C
- Process connections examples: 1” NPT, 2” 150# ASME flange, DN50 PN16 flange, sanitary flanges
- ATEX or CSA approval for hazardous areas

A copy of the product brochure is available on request by quoting V12/03-1

ViscoTron VT-G144 New

The ViscoTron VT-G144 transmitter uses digital technology to directly drive a ViscoTron or ViscoScope sensor. A high powered processor enables the use of an algorithm with accurate frequency control, which at the same time follows and controls the sensor behaviour. This technology mitigates influence from external mechanical vibrations at the source instead of masking them with a filter later.

- Viscosity, temperature and frequency measured
- Algorithm eliminates influence of cable length
- Feed forward control for improved stability
- Bright floating point LED display
- Two 4 to 20 mA outputs, RS485 serial interface

A copy of the product brochure is available on request by quoting V12/03-1

ViscoScope VS-4450 Updated

The transmitter VS-4450 has an alphanumeric display, alarm LED’s and push buttons for configuration. The model VS-B450 has the same functionality as the VS-4450 but only has the watchdog timer single LED indicator. Both transmitters can be configured with a PC.

- 4-line backlit LCD display
- Viscosity, temperature and frequency measured
- Fast PID control loop for viscosity sensor
- 4 outputs slots plus front panel RS232 interface
- Up to 4 to 20 mA outputs

A copy of the product brochure is available on request by quoting V12/03-1

info@rheologysolutions.com
Product Focus

Mineral Slurries Viscometer only A$13,610*

HAAKE Viscotester VT550 - The Recognised Industry Standard

The industry choice for viscosity measurements of mineral slurries with very disperse phases and particles using relative sensors to get reproducible results. The viscometer can be easily upgraded to R&D performance with full computer control.

Features

- Measures practical yield points using CD method (controlled deformation)
- Inhomogeneous materials measurable with particles in mm size
- Records flow curves automatically to monitor the flow behavior of a fluid or paste
- Has interchangeable rotors to extend measuring range and application
- Can be upgraded to an absolute coaxial - or cone and plate viscometer

Measuring Principle

The VT550 is a rotational viscometer where the speed of a stepper motor set by a micro step controller for high accuracy is applied to a fluid by an immersed rotor. The resistance of the fluid against this applied speed is measured by the deflection of a torsion bar (max. 1 degree) with a contact free transducer to eliminate wear. The relevant values such as speed, torque, shear rate, shear stress, viscosity and temperature are digitally displayed and sent to an RS232 printer.

Contents Of Delivery

- 362-0011 HAAKE Viscotester 550 with stand
- 098-5035 HAAKE RheoWin Software
- 808-1040 Vane rotor FL100
- 808-0579 Universal joint for FL sensors

Technical Data

<table>
<thead>
<tr>
<th>Sample Volume</th>
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<tr>
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*Price valid at January 2013. Price is subject to exchange rate variation.
**New Product Brochures**

**Graphical Touch Panel Interface**

The ViscoTouch VT-X128 display panel connects to the unit and communicates using Modbus protocol with ViscoTron and ViscoScope transmitters from Marimex Industries Corp.

The ViscoTouch graphical display panel features:

- ViscoScope software for easy configuration of ViscoTron transmitters
- ViscoView software for trending and data storage
- Software for single or multiple transmitters
- RS485 and USB interface to transmitters
- Long term storage on SD/MMC cards
- Ethernet interface for data transfer

Storage capacity of 1 GB internal flash memory can be expanded with SD/MMC storage cards. ViscoView and ViscoTools software is pre-installed on ViscoTouch panels and can be upgraded using download from the internet.

*A copy of the product brochure is available on request*

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**Product Brochures**

**Process Viscometer**

The ViscopScope VT-300 has been reinvented to provide customers with the options of different lengths or shapes for the sensor extension. There are versions to measure low, medium, high or extra high viscosities. Sensors can be constructed for pressures up to 45 bar and temperatures up to 250ºC.

The sensor is gravity dependent and can therefore be mounted in any direction. The viscometer measures the drag of a fluid at the surface of the torsionally resonating sensor. The constant amplitude twisting motion creates a constant shear wave.

The series VP-300 is available in versions to measure low, medium, high or extra high viscosities. Sensors can be constructed for pressures up to 450 bar (6,500 psi) and temperatures up to 350ºC. A PT100 inside the sensor bulb measure the temperature of the process.

*A copy of the product brochure is available on request*

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**New Product Brochures**

**Protective Coating for Process Viscometer Sensor**

The coating of wetted parts with Policoat produces a permanently impregnated, slippery surface for the release of paraffins, GIP and similar compounds commonly found in the oil industry. The coating helps to prevent build-up which extends service life, reduces maintenance frequency and downtime. At the same time Policoat also protects the wetted parts from corrosion by compounds like H₂S and CO₂.

Policoat can withstand extreme temperature from -250ºC to +300ºC. Policoat contains materials with the lowest known coefficient of friction. This means unsurpassed release of foreign material, preventing adherence and blockage.

Policoat is a protective, friction reduction coating for ViscoTron viscometer sensors from Marimex Industries Corp.

*A copy of the product brochure is available on request*
• Accessories for Rheometers

New Measuring Cell for Rheology of Building Materials

In order to carry out measurements on samples with medium and large particles, a special measuring geometry is often the only way to get meaningful data with high reproducibility. For inhomogeneous materials a large volume has to be used in order to measure a representative sample.

A new measuring cell (volume of 570 ml) has been developed for building materials that can be used with the HAAKE MARS and also the RheoStress XXXX rheometers.

This measuring cell is characterised by its variable profile. For all existing coaxial cylinders, the profile is fixed and can not be changed. The profile of the new measuring cell is exchangeable, and the profile depth can be individually chosen for each lamella.

A copy of the accessory product information sheet is available on request by quoting P006-e.

• Accessories for Rheometers

Submersion Flow Cell

A new measuring cell for measuring semi-solids submerged in a liquid has been developed. This new unit can be used with the Thermo Scientific HAAKE MARS and the Thermo Scientific HAAKE RheoStress 6000.

The new measuring cell is derived from the established SHRP measuring cell (for measurements on bitumen submerged in water), and is designed for studying the evolution of the viscoelastic properties of a material under specific “environmental conditions”. For example the softening or “plastification” of a semi-solid due to the interaction of the sample with a liquid can be quantified accurately in shear tests.

Additionally texture analysis measurements (penetrometry, etc.) can be performed by using the axial movement and normal force measurement functionality of the rheometer.

A copy of the accessory product information sheet is available on request by quoting P024-e.

• Accessories for Rheometers

SER - Extensional Rheology System

The SER system is a new accessory for the HAAKE MARS with CTC oven which transforms a (rotational) shear rheometer in an extensional rheometer for melts and semi-solids.

The measuring principle of the SER system, which was developed and improved in 2nd generation by Dr. Martin Sentmanat (Xpansion Instruments), is based on clamping the sample on two counter rotating windup drums. With the SER system a truly uniform extensional deformation in the sample is achieved. In additional to the uniaxial extension, the SER tool can be used for solid tensile testing, pear and peel testing, as well as friction testing.

A copy of the accessory product information sheet is available on request by quoting P019-e.
• Accessories for Rheometers

**Accessories for HAAKE RheoStress 6000**

- Measuring geometries for a wide variety of applications
- Application oriented measuring cells
- Software modules
- Customised accessories, compressors & circulators
- Application solutions for: polymers, petrochemical, pharmaceuticals and cosmetics, paints, inks and coatings, food.

The product brochure provides a comprehensive coverage of all the accessories currently available for the Thermo Scientific HAAKE RheoStress 6000 rheometer. It includes:
- Temperature modules for fast, precise temperature control

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**Staff News**

**The Staff of Rheology Solutions**

Left to Right from the back
- Richard Donaldson - Service Engineer
- Pradipto Bhattacharjee - Senior Scientist
- Jackie Wrigglesworth - Administration Manager
- Tim Kealy - Project Director
- Pat Griffin - Managing Director
- Kaye Griffin - Marketing Director
- Marshall Griffin - Black Labrador and Company Companion
- Evie Griffin - Border Collie and Company Companion

Marshall and Evie were the only ones who were happy with their photos and above is a close up of each of them.

Further information is available by contacting Rheology Solutions:

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Rheology Solutions

For Building & Construction Industries, Chemical & Allied Industries, Food Industries, Mineral Slurries Industries, Pharmaceutical, Cosmetic & Allied Industries, Polymer Industries & Surface Coatings Industries

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We offer a comprehensive exclusive selection of products from the leading manufacturers across material and polymer testing instruments, process rheometers, process viscometers, rheometers, sensor systems, twin screw extruders, temperature control and viscometers.
Information Request Form

From the January - June 2013 issue of RheoTalk, I am interested in the following:

• Application Notes
  Tim’s Top Tips – How to Measure... Series
  - Mineral Industries (please select)
  - Food Industries (please select)
  - Polymer Industries (please select)
  - Surface Coating Industries (please select)
  - Pharmaceutical, Cosmetic & Allied Industries (please select)
  - Building & Construction Industries (please select)
  - Chemical & General Manufacturing Industries (please select)

  Tim’s Top Tips – Explanation & Evaluation... Series
  - Tim’s Top Tips for Food Industries (please select)
  - Tim’s Top Tips for Surface Coatings (please select)
  - Tim’s Top Tips for Polymer Industries (please select)

  Rheology Solutions Information Kits (please select)
  - Mineral Slurries
  - Food Industries
  - Surface Coatings
  - Polymer Industries
  - Chemical & General Manufacturing
  - Pharmaceutical, Cosmetics & Allied Industries

• Technical Papers
  - Comparisons of Drying Operations on the Rheological Properties of Derivatised Whey Protein Thickening Ingredients - RF-180902-US-01
  - Time-Temperature Studies of Gellan Polysaccharide Gelation in the Presence of High Levels of Co-Solutes - RF-190902-CA-01
  - Measurement of Ceramic Slurry for Porcelain, Ceramic Tiles and Sanitary Industries - MX-002
  - Rheological Analysis of the Stability Of Pharmaceutical Suspensions - V154
  - Influence of the Incorporation Sequence of Different Components on the Energy Consumption of the Mixing Process with the HAAKE PolyLab QC - LR-65
  - Curing of an Acrylate Glue - Rheology with Simultaneous FTIR-Spectroscopy - V-254
  - Solvent Trap and Double Cone System for Reproducible Results in Rheological Measurements of Low Viscous Volatile Fluids - V229
  - Production of a Blend of Two Different Concentrations by a Parallel Double Screw Extruder and a Further Processing Through a Melt Pump and Following Measurement of the Rheological Characteristics in Slot and Rod Capillary Dies - LR-38
  - Optimisation of the Filling Process of Shampoo Sachets with the HAAKE CaBER 1 - V-204
  - The Influence of Thickeners on the Application Method of Automotive Coatings and Paper Coatings - HAAKE CaBER 1 - V-206
  - Correlation of Misting during Printing with Extensive Rheological Investigations on Offset Printing Inks with the HAAKE CaBER 1 - V208
  - Optimising and Forecasting the Filling Behaviour of Coatings with the HAAKE CaBER 1 - V211
  - Cryopreservation of Mammalian Oocytes and Embryos - TC05-3
  - Application Solutions using Extensional Rheology - 623-2058 V1
  - Rheology combined with Spectroscopy - 623-2129 V1
  - Measuring of Fast UV Curing Materials using Oscillatory Measurements - V-246
  - Detailed Analysis of Curing Reactions of Polyurethane Resins - V-247
  - Slurry Rheology and Pipeline Transport Properties - Rheo013TP
  - Thixotropy
  - Yield Stress
  - Flow & Viscosity
  - Thixotropy
  - Yield Stress
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  - Yield Stress
  - Flow & Viscosity

• Comments:

Please post or fax this form to:
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Phone: 03 5367 7477 • Fax: 03 5367 6477 • Email: info@rheologysolutions.com • Website: www.rheologysolutions.com
From the January - June 2013 issue of RheoTalk, I am interested in the following:

• Products

Optical Control Systems Products
- Film Inspection Systems - FSP600

Rheometers - Viscometers
- Modular Advanced Modular Universal Rheometer - Thermo Scientific HAAKE MARS III
- Solvent trap
- Submersion Flow Cell
- Modular Controlled Stress Rheometer – Thermo Scientific HAAKE RheoStress 6000
- Temperature modules
- Software modules
- Literature
- Extensional Rheometer - Thermo Scientific HAAKE CaBER 1
- Rotational Viscometer - Thermo Scientific HAAKE Rotovisco 1 Viscometer
- Portable Viscometer - Thermo Scientific HAAKE Viscotester 1 Plus
- QAS/OC Viscometer - Thermo Scientific HAAKE VT E, D, C
- Rheonut Module & FTIR-spectroscopy
- SER - Extensional Rheology System
- Double cone system
- CTC Oven
- Application oriented measuring cells
- Application solutions

Polymer Equipment
- Hot Melt Extrusion - Thermo Scientific Pharma 16 HME
- Twin-Screw Extruder - Thermo Scientific HAAKE PolyLab CS
- Micro compounder - Thermo Scientific HAAKE MiniLab
- Controlled Rate Viscometer - Thermo Scientific HAAKE Viscotester 550
- Falling Ball Viscometer - Thermo Scientific HAAKE Falling Ball Viscometer
- Portable Viscometer - Thermo Scientific HAAKE Viscotester 2 Plus
- Conical Micro Hot Melt Extrusion - Thermo Scientific Pharma mini HME
- Torsional Rheometer - Thermo Scientific HAAKE PolyLab QC
- Twin-Screw Extruder - Thermo Scientific Process 11
- Viscometer Transmitters – Marimex ViscoTron & ViscoScope Transmitters

Process Viscometers
- Viscometer Sensors – Marimex ViscoTron VP Sensors
- Temperature Control
- Fogging Tester - Thermo Scientific Horizon Fog Testing System
- Heating Circulators - Thermo Scientific SAHARA Range
- Immersion Circulators - Thermo Scientific Premium Range
- Recirculating Chiller - Thermo Scientific Polar Range
- Ultra Low Refrigerated Circulators - Thermo Scientific GLACIER Range
- Recirculating Chiller - Thermo Scientific NESLAB ThermoFlex Range
- Refrigerated Circulators - Thermo Scientific ARCTIC Range
- Recirculating Chiller - Thermo Scientific ThermoChill Range
- Refrigerated Circulator - Cool Tech Plus

• Brochures

- Flexible Twin-Screw Extruder - Thermo Scientific Process 11
- Chillers and bath circulators - Smartnote 02
- Marimex Process Viscometers - V12/03-01
- ViscoTron VP-1000
- ViscoTron VT-300
- Measuring Cell for Rheology of Building Materials - P006-e
- SER - Extensional Rheology System - P019-e
- Graphical Touch Panel ViscoTouch - VT-X128
- Customer Case Study - Ensuring Consistent Quality of PVC Compounds - 2012-0313
- Chillers - Smartnote 01
- Bath Circulators - Smartnote 03
- ViscoTron VP-3000
- ViscoTron VT-6144
- Protective Coating for Process Viscometer Sensor - Policoat
- Submersion Flow Cell - P024-e
- ViscoScope - VS4450
- Accessories for HAAKE RheoStress 6000

• Services

- Calibration & Service. Please provide details on model of product and serial number: ..............................................