REOKONSA

We help your company get the right flow

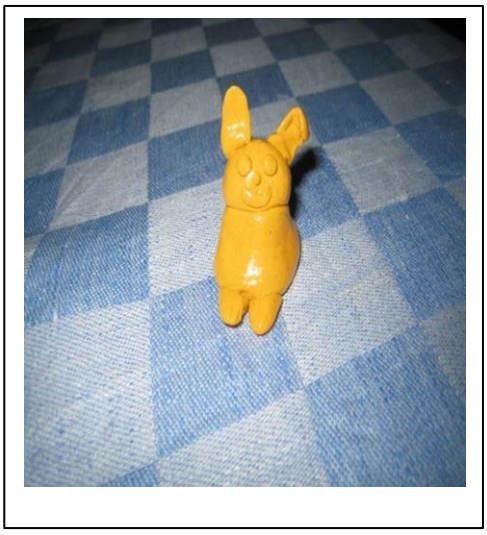
e-TRAINING

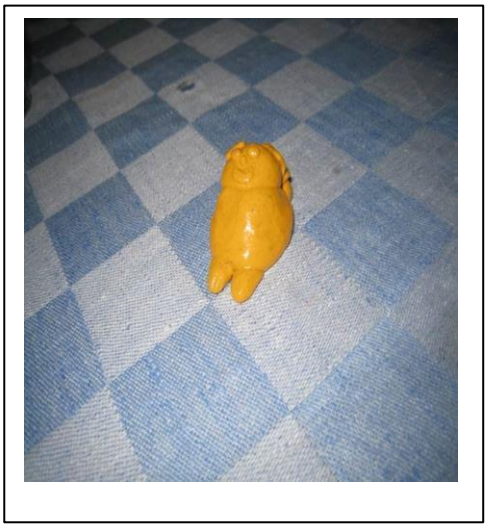
Oct 7-8, Nov 4, 2024

Rheology step 1

Principles of Rheology and its Measurement techniques

Viscosity, Elasticity and Viscoelasticity





Fresh *After 12 h*

Panta Rei…….

For whom:

Rheology is the science of flow and deformation of materials. The viscosity of a material is related to its resistance to flow while the elasticity is related to its degree of structure. To develop and then determine the consistency of a material both its viscosity and elasticity parameters must be understood and studied.
The rheological properties of a material are determined by the temperature, the pressure and the strain or the shear rate. Knowing the magnitude of these parameters in industrial processes as well as during customer handling the viscous and the elastic properties of a material can be studied in a laboratory environment by using fundamental rheological instruments such as rheometers. The measurement results can be used to study different material properties such as handling properties, sensory properties, storage stability,consistency, melting temperature, hardening temperature/time, shear stability and molecular weight. It can also be used to optimise product quality and to predict the impact of an industrial process on a specific product formulation.

The objective of this training is to give the participants basic knowledge in both theoretical and applied rheology in order to fully understand what rheology is about and how it can be used to study and to develop different material properties. The training also covers a discussion on different types of rheological instrumentation and corresponding measurement techniques to be used for material characterisation. The training combines theory with many practical examples. Post training all participants get free e-support to all questions that may arise when starting to practicing rheology.

This training is appropriate for me who:

- I have never worked with rheology before but need to get an understanding of what it is about and how I can use it. No previous knowledge is required.
- I have a theoretical knowledge of rheology but I have no practical experience. I need to understand how to relate rheological theory to rheological measurement results.
- I understand the rheological concepts but I do not know which rheological measuring method to use to study a specific rheological property of my material.
- I regularly work with rheological measurements but I want to learn more about what I am really measuring and how to interpret my measurement results, also to be able to conclude what are measurement errors and what are true material properties.
- I want to understand how to design a rheological measuring method to study specific rheological properties in order to be able to communicate with those who perform the practical measurements.

Topics to be covered during the training:

An introduction to rheology
A general presentation of the science of rheology and its application in different industrial branches. Concepts like liquids, solids, viscosity, elasticity, viscoelasticity and the Deborah number will be explained.

Basic rheological concepts
The most important concepts of rheology are defined: shear stress, shear rate, strain, viscosity, elasticity and extensional viscosity. Parameters influencing the magnitude of these concepts will also be introduced. The viscosity of some known liquids is given as well as the shear rate of different industrial processes.

Experimental rheological techniques
Fundamental and empirical rheological instrumentation and measurement techniques are presented and the corresponding application of the measurement results in material characterisation is discussed. It is shown that empirical measurement results only can be used for comparative reasons whereas fundamental results can be used for calculations of different material properties. Similarities and differences between controlled strain and controlled stress measurements will be explained.

Viscometry
The flow behaviour of different liquids is presented: Time Independent liquids, such as Newtonian, shear thinning, shear thickening and yield stress and Time Dependent liquids, such as thixotropic, rheopectic and anti-thixotropic. The flow behaviours are presented in different linear and logarithmic viscosity and flow diagrams. Rheometry, that is the practical application of rheology, is discussed in relation to the different flow behaviours. For instance different measurement techniques must be applied to differentiate between shear thinning and thixotropic flow behaviour. Measurement data are fitted to different flow models such as the Power Law, Bingham, Herschel Bulkley and the Casson model to simplify the presentation of rheological measurement data over a wide shear rate range.

Linear viscoelasticity
Linear viscoelasticity is defined both practically and theoretically. It is explained how linear viscoelastic measurements correspond to the degree of structure of a material. Viscoelastic concepts such as complex modulus, storage modulus, loss modulus, relaxation modulus, phase angle, dynamic viscosity, creep compliance and complex viscosity are defined and a mathematical approach to the relation between the different concepts is given. Rheological measurements in simple shear mode and simple mechanical models like the spring and the dashpot are introduced to simplify the interpretation of rheological measurement data. Viscoelastic flow models such as the Maxwell and the Kelvin models are introduced. In viscoelasticity, these models are the link between theoretical and practical rheological flow and deformation behaviour. Linear viscoelastic measurement methods are presented, such as oscillation, relaxation and creep and the measurement methods are illustrated by several worked examples.

Rheometry - general rheological measuring methods and interpretation of rheological measurement results

A practical and useful guide is given, based on worked examples, to successfully applied measurements in viscometry, frequency sweep, strain sweep, stress sweep, creep and relaxation modes. The corresponding measurement results are interpreted to relate rheological parameters to material properties. Advice on appropriate measuring geometries for different materials are given, like cone/plate, plate/plate and concentric cylinders. Rheological measuring techniques for studying material properties are defined for consistency, storage stability, process viscosity, shear stability, mouth feel, sagging, levelling, hardening, molecular weight and gel strength.

Questions that will be answered during the training:

- What rheological parameter gives me which information about my material?
- Why does the viscosity of my material change during shearing?
- Why is the flow rate of my material not the same as the shear rate of the material?
- Can my material behave both as a liquid and a solid? What are the consequences?
- How can I measure the shear stability of my material?
- Why is the viscosity of my material different when I use different types of viscosity instruments?
- Which rheological instrument should I use and how does this instrument influence my measurement results?
- How does the selected measurement geometry influence my measurement results?
- Why is the knowledge of the linear viscoelastic region of my material important? What does it mean in terms of material properties?
- How does rheology relate to the processing and sensory properties of a material?
- Is my material shear thinning or thixotropic?
- How do I design and define a rheological measurement method?
- How do I translate rheological measurement results into true material properties?

Course leader

Annika Sahlström is a rheology consultant at Reokonsa AB.

Annika has a Master of Science in chemical engineering and more than 30 years of practical, theoretical, consulting and teaching knowledge within most industrial applications. In 1997 Annika was honoured with 'The Rheology Award of the Year' by The Nordic Rheology Society for her skills in teaching understandable rheology, combining theoretic rheology with practical examples and demonstrations to address different learning styles. By now Annika has more than 1000 satisfied clients.

After her graduation at Lund University of Technology Annika worked at Bohlin Reologi AB, a company developing and selling rheological instrumentation. Here Annika came in contact with most industrial applications and rheological challenges and acquired a wide knowledge within rheological measurement techniques and instrumentation. She was also responsible for training of international users.

At other employments Annika has widened her rheological application knowledge. At AAK she combined different measuring techniques to study fat based systems. At Tetra Pak she worked with process design in relation to the installation of filling machines and processing equipment for liquid food products. At Nestlé she worked with development and industrialisation of new food products.

In parallel with her employments Annika has been working as an international rheology consultant helping companies within most industrial applications, understanding and applying rheology in order to efficiently study and steer the rheological properties of their materials, as well as giving general and customer tailor made Basic and Advanced Courses on rheology.

Training schedule

October 7-8, Nov 4, 2024.

e-Registration at 09:00 October 7.

Course ends at 16:00 each day.

The training is given in English. English documentation. A course certificate is handed over to all participants.

Day 1:

9-12
- An introduction to rheology
- Basic rheological concepts
- Experimental rheological techniques

12-13 Lunch

13-16 Viscometry, part 1

Day 2:

9-12
- Viscometry, part 2
- Linear Viscoelasticity

12-13 Lunch

13-16

- Cont. Linear viscoelasticity
- Applied rheology
- Planning of day 3

Day 3:

Planned together with the participants to bring most value.

Course fee

SEK 22 000 or EUR 2200

10% reduction of the training fee is given to no 2 and more of participants from the same company attending the same training occasion.

VAT will be added for participants from Sweden.

No refunds will be made for those who do not attend the scheduled course and/or cancel after September 6, 2024.

Training documentation and free post e-mail/e-support are included in the training fee.

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Registration

To register for this training please send an E-mail no later than September 6, 2024 to:

reokonsa@gmail.com

with the following information:

I hereby register for Rheology step 1 – Principles of Rheology and its Measurement techniques; Viscosity, Elasticity and Viscoelasticity

* First name:

* Surname:

* Job Title:

* Company/Institute:

* Address:

* Country:

* Tel no (mobile if applicable):

* E-mail:

* Purchase Order number (if required by your company):

* Invoice address if different from the one above:

* Company VAT number:

* It is OK to be added to Reokonsa AB's address register (*) Y/N:
(*) See Reokonsa AB's web page for our GDPR rules

Latest registration by September 6, 2024.

In combination with the registration to the training all practical information related to the training will be given.

Questions?

Contact: Annika Sahlström

reokonsa@gmail.com or +46 709787805