

NORDIC RHEOLOGY CONFERENCE 1999
ANNUAL MEETING OF THE NORDIC RHEOLOGY SOCIETY
IN LYNGBY, DENMARK, JUNE 9TH-11TH, 1999

**Conference
Report II**

The annual meeting of the Nordic Rheology Society (NRS) was held within the Technical University of Denmark (DTU), situated in Lyngby, a northern suburb of Copenhagen. This was the 8th meeting of the NRS and the special theme this year was "Process Rheology and measurements", although papers from a wider aspect of rheology were also presented. The conference was organised by a committee, headed by P. Szabo, of DTU with other members being A. Friis and M. Norsker, both of DTU, R. Ipsen of the Royal Veterinary and Agricultural University (KVL), B. Unni Marr, Copenhagen Pectin A/S and H. Kragh, formerly of the Biotechnological Institute in Kolding but now of Danisco Ingredients.

A rheological course, entitled "Interpretation of Rheological Measurements" was run a day before the conference proper began. Around 40 participants were treated, by the 4 invited lecturers; M. Larsson, K. Almdal, M. Stading and O. Hassager, to a wide ranging journey through the subject. Topics dealt with included; Interpretation and control of measurements and results from rheometers; Dynamical mechanical spectroscopy and viscosity measurements; Structural rheology in biopolymer and colloidal systems; and Rheology-Chain structure relationships in polymers. In addition to the commonly understood techniques discussed, a vision of the future for rheology was offered.



Figure 1 (upper): Invited lecturers professors Nick Hudson from University of Strathclyde (left) and Lionel Choplin from GEMICO, Univ. of Nancy.

This talked of the potential to access meaningful data from the non-linear portion of the oscillatory stress or strain curves by way of Fourier transform. Currently, this is beyond the reach of all but a handful of rheologists, but it was speculated that in the coming years more work would be done to unlock this, as yet, underdeveloped sub field.

The conference itself, attended by some 90 delegates, featured two key-note lectures and a session devoted to the main theme, process rheology. Over the course of the two days, delegates heard 19 presentations which also included sessions on, experimental techniques, food rheology, general rheology, polymers and a poster session. The conference was opened by some welcoming words from the NRS secretary, P. Szabo, before the first key-note lecture.

This was delivered by Prof. L. Choplin of GEMICO-ENSIC, Nancy, France. The title of his lecture, "Rheo-reactor for in situ rheological recording during chemical and/or physical processes.", was merely the springboard from which to launch the delegates into the mechanisms for rheological data being extracted from real processes. The subtleties of the technique were demonstrated by introducing the Metzner-Otto average shear rate concept, which for steady state and laminar regimes allows a process rheogram to be obtained. Two different impellers were used as examples, a helical ribbon and

Figure 2: Per Andersen from Oleinetic demonstrating the new Physica rheometer for Søren Hvidt from Roskilde University. Søren Hvidt got this years Carl Klason Rheology Award.



Figure 3: The organizing committee of the Nordic Rheology Conference 1999, from left: Richard Ipsen (Royal Veterinary and Agricultural University, Copenhagen), Henrik Kragh (Bioteknologisk Institut, Kolding), Merete Norsker (The Technical University of Denmark, Lyngby), Peter Szabo (The Technical University of Denmark, Lyngby).

horseshoe anchor types, where the viscosity data obtained from the Metzner-Otto rheogram and a conventional rheometer showed excellent agreement. Data was also presented to demonstrate the rheo-reactors capability to extract viscoelastic parameters provided the oscillatory motion of the impellers were small enough to remain within the linear viscoelastic region.

Again good correlation was found between the rheo-reactor and the conventional rheometers. These types of rheo-reactors are interesting because they offer the opportunity to gain rigorous rheological data directly from the process line in either batch or semi-batch conditions without the 'down time' of waiting for conventional analysis to be performed. Also the integrity of the sample is preserved.

The first day also took in the sessions on food rheology, of large interest within the Scandinavian countries. The delegates heard presentations on potato starch gels, (A.M. Bay-Smith, Denmark); rheology of biscuit dough, (L. Pedersen, Denmark); food crispiness – meringues (R. Ipsen, Denmark); liquorice functionality, (M. Norsker, Denmark) and non-fat yoghurts, (B. Unni Marr, Denmark). Within the poster session, food was also well represented with potato tissue, (M. Nielsen, Denmark) and b-lactoglobulin / potato amylopectin gels, (C. Olsson, Sweden) being examined. Other contributions included gelation of triblock copolymers, (H.L. Bagger, Denmark) and electrically conducting network structures of polyaniline, (M. Tiitu, Finland).

The second key-note lecture opened the last day of the conference and was presented by Dr. N.E. Hudson of Strathclyde University, Glasgow, entitled, "The rheological audit of the process". This took a practical look at the problems facing the rheologist with respect to developing and optimising a new or existing product. The first problem to face the rheologist was whether they



should use in- or on-line instruments to check the materials progress through the process. A number of advantages and disadvantages were presented for both types, but the ultimate rheometer for process control should possess three main characteristics; robustness, be relatable (to results from research rheometers) and provide results representative of the sample – in the

process! With these ground rules laid out, examples of the coatings industry (printing inks) were given where a knowledge of the extensional viscosity proved vital to the production of a good coating agent. The esoteric variances of extensional flow for strain hardening and thinning fluids were presented and it was shown that after exceeding a critical strain rate, a strain hardening fluid could be expected to fail cohesively resulting in the undesirable phenomenon known as 'ink fly' whereas a strain thinning fluid would give a uniform covering. Other properties of the printing ink discussed included shear thinning, thixotropy, yield value, relaxation time, Deborah number and elasticity. Through sample knowledge and process conditions an audit was built up and the underlying trend presented was that for most processes, it was large deformation measurements that were of prime importance. The speaker was questioned on this apparent omission of dynamic parameters, to which the response was that whilst important, if not vital, to characterise the material, they did not represent very important parameters within the process itself – presumably due to the non-linearity of the conditions therein.

The more theoretical lectures were presented on the second day with a number of talks dealing with numerical simulation and modeling. Two presentations dealt with

- (1) viscoelastic instability in polymeric filaments (H.K. Rasmussen, Denmark), where surface tension was shown to delay the instability.

(2) Capillary thinning of polymeric filaments, (P. Szabo, Denmark), where the simple theory of Newtonian fluids failed to predict filament thinning and although in the correct order of magnitude, the largest relaxation times were not predicted accurately by the simple theory of viscoelastic flow.

Away from the more theoretical aspects, a presentation of ionic and acid gel formation in epimerised alginates (K.I. Draget, Norway), was given. This demonstrated the link between rheology and ^{13}C nmr as a technique for following the gelation process.

The social arrangements, always a highlight of the NRS meetings, were no different this year. They included a reception at the Town Hall of Lyngby with a welcome speech from the mayor. This preceded a sail on Lakes Lyngby and Bagsværd which included a meal. However, the main event was a guided tour of Frilandsmuseet, an open air museum in Copenhagen featuring old houses and farms from throughout Denmark, which was followed by the conference dinner. During the dinner the Carl Classon Rheology award of the Society was presented to Dr. S. Hvidt of Roskilde University for his long and appreciat-

ed work in rheology not only in academia but also industry within the Scandanavia. He has been responsible for the considerable development of rheology within the Nordic countries and is now also one of the first points of contact people approach for help, in attempting to solve their rheological problems. The award was gratefully received and during his short acceptance speech he paid tribute to another of the societies members, Prof. O. Kramer, for his long standing help and support.

The next meeting will take place in Helsinki (2000). The exact date of the meeting is yet to be fixed but further details for this will be found in due course on the NRS web page:

www.sik.se/nrs/

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