

## NRC and AERC 2010



Photo: Göran Assner

The next Nordic Rheology Conference is already in April and it is therefore time to submit abstracts and to register. The NRC will this time be part of the Annual European Rheology Conference which gathers around 400 participants.

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This means that the selection of seminars is wider, there are more keynote and plenary lectures, the exhibition is bigger – in short: there is more to choose from. The NRS is organising the event and we will have our Annual Business Meeting on Thursday April 8. All abstracts will be published in an Abstract Book, but NRS members also have the unique opportunity to publish results in the NRS Annual Transactions. If you are an NRS member and student you can also apply for the NRS Student Travel Grant. More information on the conference is found on the AERC web page as well as on the NRS web page.

[www.rheology-esr.org/AERC/2010](http://www.rheology-esr.org/AERC/2010)

Submit your abstracts before December 3 and send a mail to the NRS Transactions Editor Henrik Persson ([Henrik.Persson@chalmers.se](mailto:Henrik.Persson@chalmers.se)) to be included in the 2010 Transactions.

Plenary lectures will be given by **David Boger** on “*Environmental Rheology*” and **Ole Hassager** on “*How big are Polymers?*”

Keynote speakers for different symposia are:

**Manfred Wagner**, Technical University of Berlin (symposium: polymer melts and solutions); **Oliver Harlen**, University of Leeds (modeling, simulation and computational rheology); **Olivier Pouliquen**, Polytech Marseille (dispersion rheology); **Helmut Münstedt**, University of Erlangen (rheometry); **Sandra Lerouge**, Université Paris 7, and **Erich Windhab**, ETH Zürich, (complex flows; joint talk); **Nikolai Denkov**, Sofia University (interfacial rheology, emulsions and foams); **Peter Fischer**, ETH (food and bio-rheology); **Nor-man J. Wagner**, University of Delaware (complex fluids); **Luca Cipelletti**, Université Montpellier 2 (microrheology and microfluidics); **Norbert Willenbacher**, University of Karlsruhe (applied rheology); **Hongbing Lu**, University of North Texas and **Masayuki Nakada**, Kanazawa Institute of Technology in (rheology of solids; joint talk); **Mathias Fink**, Institut Langevin (Ultrasonic techniques – ISUD 7)

### Important Dates

December 3, 2009	Last date for submission of abstracts for oral presentations, Dec 10 for posters on the AERC web page. Send also a mail to the editor <a href="mailto:Henrik.Persson@chalmers.se">Henrik.Persson@chalmers.se</a> for the NRS Transactions.
January, 2010	Notification of acceptance of submitted abstracts
February 15	Last date to register for low fee, last date for pre-booked hotel rooms, Contributions to NRS Annual Transactions to be submitted to the editor.
April 6	AERC2010 courses
April 7	AERC2010 starts
April 8	NRS Annual Business Meeting

## Environmental Rheology and More

By Mats Stading and Magda Kniola

**Slimy fluids, cheap instruments and waste may not sound as something to be famous for. Boger fluids, successful applications and environmental engineering sounds better, but all these buzz words can be traced back to David Boger.**

In his early career David Boger found that by adding a small amount of polymer to a Newtonian fluid you could get a fluid with constant viscosity which at the same time was highly elastic<sup>1</sup>. This class of fluids, which later was named after him turned out to have interesting flow properties. They have been beautifully visualized<sup>2</sup> and elastic liquids have been exploited in several applications. A main advantage of Boger fluids was that they made it possible to separate contributions of fluid inertia from shear thinning. The flow of Boger fluids is also quite challenging to describe theoretically and they have therefore become a favourite for theoretical rheologists as a challenging test of new models.

After a PhD at University of Illinois in Urbana in 1965 David Boger left USA and moved to a position at Monash University in Melbourne where he got involved in the study of viscoelastic fluids. In 1982 he took up an appointment as professor of Chemical Engineering at the nearby University of Melbourne. In addition to basic studies of viscoelastic fluids David Boger has been much involved with rheological flows in the industry eventually leading to the field of environmental rheology. It has also given the engineering community several practical measuring techniques of varying degrees of sophistication. The "50 cent rheometer"<sup>3</sup> is a through analysis of the slump test commonly used in both the cement and mining areas. This has recently been followed by the "Bucket rheometer"<sup>4</sup> for accurately determining flow curves of industrial suspensions. The use of the vane measuring system<sup>5</sup> is also an area well studied by David Boger and co-workers.

Environmental rheology is used in the mining industry to decrease water use. When the mined

metal or precious gem is extracted the finely ground rock has to be discarded. The classical way has been to pump a fairly dilute dispersion to dams where the particles have been left to sediment. This requires huge amounts of fresh water which often is a limited resource, especially in arid mining areas. If instead a concentrated dispersion can be pumped and deposited much less water is used. This requires good knowledge in how these dispersions flow in order to avoid clogging and pump failure. David Boger will present his work in environmental rheology at the opening lecture of the AERC 2010.

The desirable properties of Boger fluids are that they should be liquids, optically clear, highly elastic at room temperature, have a constant viscosity independent of the shear rate up to rather high shear rates and have a Maxwell-model relaxation time comparable to that of a typical molten polymer under processing conditions.

The viscosity of a polymer, which constitutes of long, entangled polymer chains, decreases with increasing shear rate i.e. it is shear-thinning. The shear-thinning effect occurs due to disentanglement and alignment of the polymer chains when sheared, making the polymer more susceptible to flow. Boger fluids consist of a much diluted solution of a non-entangled, high molecular weight polymer in a very viscous Newtonian solvent. In a dilute solution the polymer coils are well separated and the viscosity contribution from the polymer to the total viscosity is very small, making the shear-thinning effect small<sup>6</sup>. The benefit of Boger fluids is that the simplicity of dilute solutions is combined with the long

Don't miss the plenary lecture  
"Environmental Rheology" by  
David Boger in AERC & NRC  
2010 in Gothenburg, Sweden,  
April 7-9

relaxation times of polymers which allow measuring nonlinear viscoelastic effects at low shear rates.



David Boger

The first Boger fluid consisted of a low concentration (0.08%) of polyacrylamide in a concentrated aqueous sugar solution (maltose syrup) and had a nearly constant viscosity close

to 22 Pas for shear rates up to  $1050 \text{ s}^{-1}$ . The relaxation time was approximately 4 s, making it comparable with the timescale of polymer melts undergoing high-temperature processing<sup>7</sup>.

1. Boger, D.V., (1977) "Highly elastic constant-viscosity fluid" *J. Non-Newton. Fluid Mech.*, 1977. 3(1), 87-91.
2. Boger, D. and Walters, K. (1993) "Rheological phenomena in focus", Elsevier
3. Pashias, N., Boger, D.V., Summers, J. and Glenister, D.J. (1996) "A 50-cent rheometer for yield stress measurement", *J. Rheol.*, 40(6), 1179-1189
4. Fischer, D.T., Calytom, S.A., Boger, D.V. and Scales, P.J. (2007) "The bucket rheometer for shear stress-shear rate measurement of industrial suspensions", *J. Rheol.*, 51(5), 821-831.
5. Nguyen, Q.D. and Boger D.V. (1986) "Direct yield stress measurement with the vane method", *J. Rheol.*, 29(3), 335-347.
6. James, D.F., (2009) "Boger Fluids", *Ann. Rev. Fluid Mech.*, 41, 129-142
7. Binnington, R.J. and D.V. Boger, (1986) "Remarks on non-shear thinning elastic fluids", *Polym. Eng. Sci.*, 26(2), 133-138.

## Rheology Discussion Group in LinkedIn

The Nordic Rheology Society has started a group for people interested in rheology on LinkedIn. All members are invited to the group by e-mail, but the group is open to everybody interested in rheology.

We hope that this group can work as a virtual meeting place and discussion forum for our members and other rheologists. If you have a rheological question or challenge, please feel free to start a discussion and hopefully you'll get the answers you are looking for. LinkedIn gives you the opportunity to get in contact with and stay in touch with people you meet at conferences and meetings all over the world. The group can also be used to send announcements/news and for posting available jobs. You can become a member of the NRS group without being linked to all members in the group

LinkedIn is an interconnected network of

experienced professionals from around the world, representing 170 industries and 200 countries. You can find, be introduced to, and collaborate with qualified professionals that you need to work with to accomplish your goals. LinkedIn is free to join but they also offer a premium version to give you more tools for finding and reaching the right people, whether or not they are in your network.

If you have not received an invitation to join the group you can contact the NRS board or sign up on [www.linkedin.com](http://www.linkedin.com).



## Calendar of Events

- 14-15 Dec 2009 **BSR Midwinter Meeting 2009, Edinburgh, UK**  
**R. Besseling**  
[j.h.j.thijssen@ed.ac.uk](mailto:j.h.j.thijssen@ed.ac.uk), [cspcbsr2.ncl.ac.uk/bsr/frontend/meetings.asp](http://cspcbsr2.ncl.ac.uk/bsr/frontend/meetings.asp)
- 25 Feb 2010 **Complex Fluid-Fluid Interfaces, London, UK**  
 L. Cornwell  
[lisa.cornwell@iop.org](mailto:lisa.cornwell@iop.org),  
[www.iop.org/Conferences/y/10/CFFI10/index.html](http://www.iop.org/Conferences/y/10/CFFI10/index.html)
- 10-12 Mar 2010 **Rheology of Colloidal Systems (Joint Symposium of the German Rheological and Colloid Societies), Karlsruhe, Germany**  
 N. Willenbacher  
[drq@bam.de](mailto:drq@bam.de), [www.drq.bam.de](http://www.drq.bam.de)
- 20-24 Mar 2010 **Food Colloids 2010, Granada, Spain**  
 M.C. Vilchez  
[fc2010@ugr.es](mailto:fc2010@ugr.es), [www.foodcolloids2010.org](http://www.foodcolloids2010.org)
- 7-9 Apr 2010 **6th Annual European Rheology Conference (AERC & NRC 2010), Gothenburg, Sweden**  
**M. Stading**  
[ms@sik.se](mailto:ms@sik.se), [www.rheology-esr.org/AERC/2010](http://www.rheology-esr.org/AERC/2010)
- 15 Apr 2010 **Rheology in Particular: Crude Oil, Aberdeen, UK**  
 C. Stöber  
[seminar.mc.de@thermofisher.com](mailto:seminar.mc.de@thermofisher.com)  
[www.thermo.com/mc\\_seminar](http://www.thermo.com/mc_seminar)
- 9-11 Jun 2010 **IDF Symposium on Microstructure of Dairy Products, Tromsø, Norway**  
 J. Seifert  
[jseifert@fil-idf.org](mailto:jseifert@fil-idf.org), [www.idfmic2010.no](http://www.idfmic2010.no)
- 20-23 Jun 2010 **5th International Conference on Times of Polymers (TOP) and Composites, Ischia, Italy**  
 A. D'Amore  
[top2008@unina2.it](mailto:top2008@unina2.it), [www.unina2.it/top5/](http://www.unina2.it/top5/)
- 23 Jun 2010 **Rheology in Particular: Petroleum, Stavanger, Norway**  
 C. Stöber  
[seminar.mc.de@thermofisher.com](mailto:seminar.mc.de@thermofisher.com)  
[www.thermo.com/mc\\_seminar](http://www.thermo.com/mc_seminar)
- 5-8 Jul 2010 **International Soft Matter Conference 2010, Granada, Spain**  
 R. Hidalgo-Alvarez  
[rhidalgo@ugr.es](mailto:rhidalgo@ugr.es), [ismc2010.ugr.es](http://ismc2010.ugr.es)
- 24-28 Oct 2010 **82nd Annual Meeting of The Society of Rheology. Santa Fe, New Mexico, US**  
 Andy Kraynik  
[www.rheology.org/sor/](http://www.rheology.org/sor/)

## The NRS Board

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