

Basics of Rheology Workshop 2011

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Conference Report III

People working in industry come to the subject of rheology in many different ways. Training from more experienced colleagues and learning on the job are the usual ways of acquiring knowledge of rheology. When more insight is required and there are questions to be answered: where to go then? The Austrian rheometer manufacturer Anton Paar has been offering “Rheology Workshops” at locations around the world since 1988. To date, over 4500 participants have taken part in the seminars. The workshops provide an introduction to the subject for users of rotational and oscillatory rheometers and are specially targeted at practical users in industry with little or no background in the theory of rheology. As Thomas Mezger of Anton Paar Germany explains: “The main aim of the basic rheology seminars is to explain rheology in an understandable way and show that it can even be fun. At the end, participants are able to discuss viscoelastic properties and also understand many other rheological terms.”



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Figure 1 (page 303): Attendees of the “Basics of Rheology Workshop” held in Graz in June 2011.

Figure 2 (left): Typical seminar situation.

Figure 3 (middle): The seminar took place at the headquarters of Anton Paar in Graz.

Figure 4 (right): Sightseeing in Graz: The Schlossberg.

The number of participants is limited, allowing time for individual questions and discussions. The workshop in Graz from June 29 to 30 was typical: 26 people took part, coming from different industry branches such as the technology of polymers, adhesives, coatings, ceramics, food and medicals. The two-day workshop included around 6 hours of theory, and 2 hours of demonstrations on rheometers per day, the latter given by Michael Ringhofer, Brigitte Berger and Robert Hammer, all from Anton Paar GmbH in Graz. During the first day the workshop covered an introduction to viscosity and flow behaviour: The term rheology; viscous, elastic and viscoelastic behaviour; simple viscosity test methods, flow cups, capillary and falling ball viscometers; rotational tests using relative and absolute measuring systems: spindles, stirrers, concentric cylinders, cone-and-plate, parallel plates, double-gap systems; definition of terms: shear stress, shear rate, (shear) viscosity; viscosity law according to Newton; discussion of rotational tests using application examples of industrial users; controlled shear rate (CSR) and controlled shear stress (CSS) tests; ideally viscous (Newtonian) flow behaviour; shear-thinning (pseudoplastic), zero-shear viscosity of unlinked polymers; shear thickening (dilatant); yield point: different test conditions and analysis methods; time-dependent flow behaviour: structure break and recovery, “thixotropic behaviour”; temperature-dependent flow behaviour: heating and melting, cooling and solidifying.

The second day focused on elasticity and viscoelastic behaviour: definition of terms: (shear) strain and deformation, shear modulus; elasticity law according to Hooke; elasticity modulus in tension or Young’s modulus; Poisson’s ratio; strain rate or shear rate; ideally elastic deformation behaviour; introduction to oscillatory tests, definition of terms: storage and loss modulus, loss or damping factor; vector diagram; discussion of oscillatory tests using application examples of industrial users; amplitude sweeps: linear viscoelastic (LVE) range; yield point and flow point; frequency sweeps: unlinked polymers and curve crossover point, complex viscosity, zero-shear viscosity, Maxwellian behaviour; crosslinked polymers; dispersions and gels: storage stability, time-dependent viscoelastic behaviour:

structure break and recovery, “thixotropic behaviour”; gel formation, hardening, thermal curing, UV curing; temperature-dependent viscoelastic behaviour of all kinds of viscoelastic materials and stiff solids (DMTA, dynamic mechanical thermoanalysis): heating, melting, glass transition; cooling, crystallization; gel formation, sol/gel transition; hardening, curing, testing solid torsion bars; extensional viscosity: strain softening or hardening of linear and branched polymer molecules.

After the first day’s many insights, participants took a walk through Graz’s beautiful historic center, finishing their sightseeing at the Schlossberg (“castle hill”) with its clock tower and remains of the medieval castle. In the modern restaurant at the top they enjoyed a relaxed meal with spectacular views over the city and surrounding hills. Thomas Mezger is usually the main lecturer at these Rheology Workshops. He is also the author of “The Rheology Handbook” which is given to each participant as part of the course documentation. “The Rheology Handbook” is available in German and English and has sold over 6000 issues in three editions in the last 10 years. Every attendee of the seminar also received eLearning CDs which are produced for those interested in self-study. Anton Paar provides these interactive eLearning courses for everyone, free of charge. In the three courses “Basics of Rheometry: Rotation” (60 min) and “Basics of Rheometry: Oscillation” (90 min) as well as “Basics of Viscometry” (45 min) the virtual rheology expert “Joe Flow” gives an introduction to the subject in an entertaining and light-hearted way. For free copies of these eLearning CDs, every reader of the Applied Rheology journal may send an email to elearning@anton-paar.com. Other seminars offered by Anton Paar include workshops for advanced users with application focus, e.g. polymers, coatings, food, cosmetics and pharmaceuticals, asphalt and further special seminars which are aimed at users of Anton Paar rheometers.

Thomas Mezger
Anton Paar GmbH
info@anton-paar.com, www.anton-paar.com