

NOVEL TRENDS IN RHEOLOGY X PROGRAMME REPORT

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July 31, 2025

This is to memorialize the exceptional meeting organized and led by Martin Zatloukal in the Faculty of Technology of Tomas Bata University in Zlín, over the Wednesday and Thursday of July 30 and 31, 2025. Each of the prior nine biennial meetings has represented a significant advancement in rheology, rheometry and their applications and this tenth meeting did not disappoint. The meeting and its contributions are already memorialized in Volume **3400** (Issue 1) of the archival *AIP Conference Proceedings*, edited by Professor Martin Zatloukal, with 16 oral contributions from Canada, United States, Germany, Japan, The Netherlands, Sweden, France, Portugal and, of course, the Czech Republic [*AIP Conf. Proc.* **3400**, 010001 (2025)]. The meeting upheld the highest of international meeting standards, and proceeded in the best traditions of the twenty-year run of the NTR meetings.

Jeff Giacomini opened the meeting and the session on Flow Instabilities with his report on a collaboration with the host Tomas Bata University on die lip buildup in extrusion [*AIP Conf. Proc.* **3400**, 020003 (2025)]. The role of macromolecular orientation on die lip build-up is explored. Savvas Hatzikiriakos gave a penetrating lecture on melt fracture suppression with processing aids. He opened by explaining the resurgence of commercial importance, attaching this to recent legislation forbidding the use of the now traditional fluoropolymeric processing aids. Savvas advanced a novel adsorption-desorption chemical reaction theory, deepening our understandings of processing aid coating dynamics and of melt fracture suppression [*AIP Conf. Proc.* **3400**, 020002 (2025)].

Jiri Vlcek opened the session on Industrial Rheology and Processing treating us to a lecture on simulating “peculiarities” in extrusion. Vlcek demonstrated the usefulness and the strengths of *Compuplast Software* for such simulations, and more broadly, for extruder die or screw design. His lecture probed melting zone stagnation and degradation in single-screw extrusion. Karen Xiao lectured on flow instabilities in multilayer film manufacturing, transporting her audience to the interfaces between layers. Her elegant analysis of interfacial stress, a clarifying explanation of its importances, and of reactive instability are to be highlighted. Dietmar Auhl closed the session with his insights into high-pressure rheology, detailing its importances to polymer composites or recyclates. The talk advanced simulation accuracy of spiral length by incorporating pressure-dependence of the rheology. Auhl sandwiched his talk between Xiao and lunch.

Following a delicious lunch, after which Xiao performed on the grand piano, Masayuki Yamaguchi opened the session Rheology of Polymeric Materials I, performing “On the Shear-Induced Crystallization of Polypropylene Blends,” at the lectern. Yamaguchi explored the intriguing interplay

between flow, including shear history, and phase change advancement [*AIP Conf. Proc.* **3400**, 040001 (2025)]. Yamaguchi detailed the transport phenomena experimentally and comprehensively with, at least, wide-angle x-ray diffraction, depolarized light, scanning electron microscopy, transient uniaxial elongational and complex viscosity measurement. Polypropylene crystallization behaviors were compared and contrasted with those of both HDPE and LDPE. Jaap den Doelder gifted his audience with insights on orientation of polyethylene films for elastic modulus enhancement. den Doelder attacked this solid-state complication as it arises in recycling, especially in multilayer films, then he sent us to break.

Zdeněk Starý brought us back from the break, opened the session Rheology of Polymeric Materials II with a delightful offering on the elasticity of polymer melts filled with glass microspheres [*AIP Conf. Proc.* **3400**, 020004 (2025)]. Starý explored relating filler interfacial area to die swell suppression. Manfred Wilhelm analyzed the fatigue in solid polymers and elastomers *via* Fourier transform of the stress in oscillatory extension. Wilhelm introduced his audience to Wöhler curve analysis for fatigue life. He then unveiled new understanding of the higher harmonics generated in oscillatory shear of solids, and their relevance to fatigue. From this we learnt that fatigue crack advancement gives rise to even harmonics in the stress. Manfred Wilhem concludes with a new method to supersede Wöhler curve analysis for fatigue life prediction. Professor Martin Zatloukal released participants from the concluded session, directing them to *Koliba u Černého Medvěda*, on the mountain, for an unforgettable dinner.

Laurence Noirez opened the second day, and its opening and penultimate session, Rheology of Polymeric Materials III, with a delightful offering on the amazing effects of the mesoscopic elasticity of fluids, specifically, with applications to polymer melts and blood plasma. Remarkably, Noirez presented thermal imaging across the gap of a fluid in (1) pressure-driven slit flow, and (2) large-amplitude oscillatory shear flow [*AIP Conf. Proc.* **3400**, 020005 (2025)]. Noirez released the participants to the poster session (competition) and exhibition. The poster session was adjudged by Professors Giacomini (chair), Wilhelm and Hatzikirikos.

Levente Szántó opened the session, Introduction of Novel Rheological Tools Non-Newtonian Fluid Mechanics, teaching with clarity about the Rosand capillary rheometer, and specifically on its features, functions, and potential. Szántó introduced and explained the new *low-level script* software, for customizing flexibly experimental designs. The session, proceeded swimmingly to Lukas Schwab who teaches on the optimization of battery electrode manufacturing, and specifically, through impedance simultaneous with spectroscopic measurements rheological. Schwab introduced a new rheometric electrode to address the special challenges of simultaneity. Philana Kruse closed the penultimate session with her incisive and artful offering on three novel extensional rheometry techniques for rotational rheometer platforms. Simultaneous optical birefringence (with mechanical stress measurement), Hencky strain limitation augmentation (using the tilted Sentmanat extensional rheometry), and high-speed polarization imaging during extension. Kruse released the participants from the penultimate session to lunch.

João Miguel Nóbrega opened the closing session, Non-Newtonian Fluid Mechanics, with an intriguing lecture on enhancing coupled numerical simulations of viscoelastic flows through physical

property analysis [*AIP Conf. Proc.* **3400**, 050001 (2025)]. Nóbrega teaches about the ARCHIVAL journal, *OpenFOAM*, the method exploits the strengths of OpenFOAM for polymer processing, and for rheological constant evaluation, which are then supplied to simulations of extrusion, for instance. The NTR meeting founder and host, Martin Zatloukal, closed the meeting with an artful and expert treatment of measurement and modeling of extensional rheology, specifically to deepen our understanding of flow instabilities in polymer processing. The highlight of the talk is his detailed account of the history of the Cogswell relation (now corrected) for extensional viscometry.

Of the nine posters presented, best poster was awarded to Xiaohe Xu (徐晓和), for his research on a novel multifunction die for simultaneous measurement of steady-state viscosity, first normal stress difference and flow instability of viscoelastic liquids *via* capillary rheology.

The next meeting of this series (Novel Trends in Rheology XI) will be organized in July 28-29, 2027 (<https://noveltrends.ft.utb.cz/>).

AIP Conference Proceedings



Volume 3400

Novel Trends in Rheology X

Zlín, Czech Republic • 30–31 July 2025
Editors • Martin Zatloukal and Jan Musil



Available Online: pubs.aip.org/aip/acp

Figure 1 Conference book.



Figure 2 Alan Jeffrey Giacomini (right) receiving the certificate from Manfred Wilhelm (left) for lecture "Die Lip Buildup and Polymer Rotarance Theory".



Figure 3 Savvas George Hatzikiriakos (right) receiving the certificate from Manfred Wilhelm (left) for lecture "Processing Aids in Eliminating Melt Fracture".



Figure 4 Jiří Vlček (right) receiving the certificate from João Miguel Nóbrega (left) for lecture "How Can Simulation Help in Understanding of "Peculiarities" in the Extrusion Process".

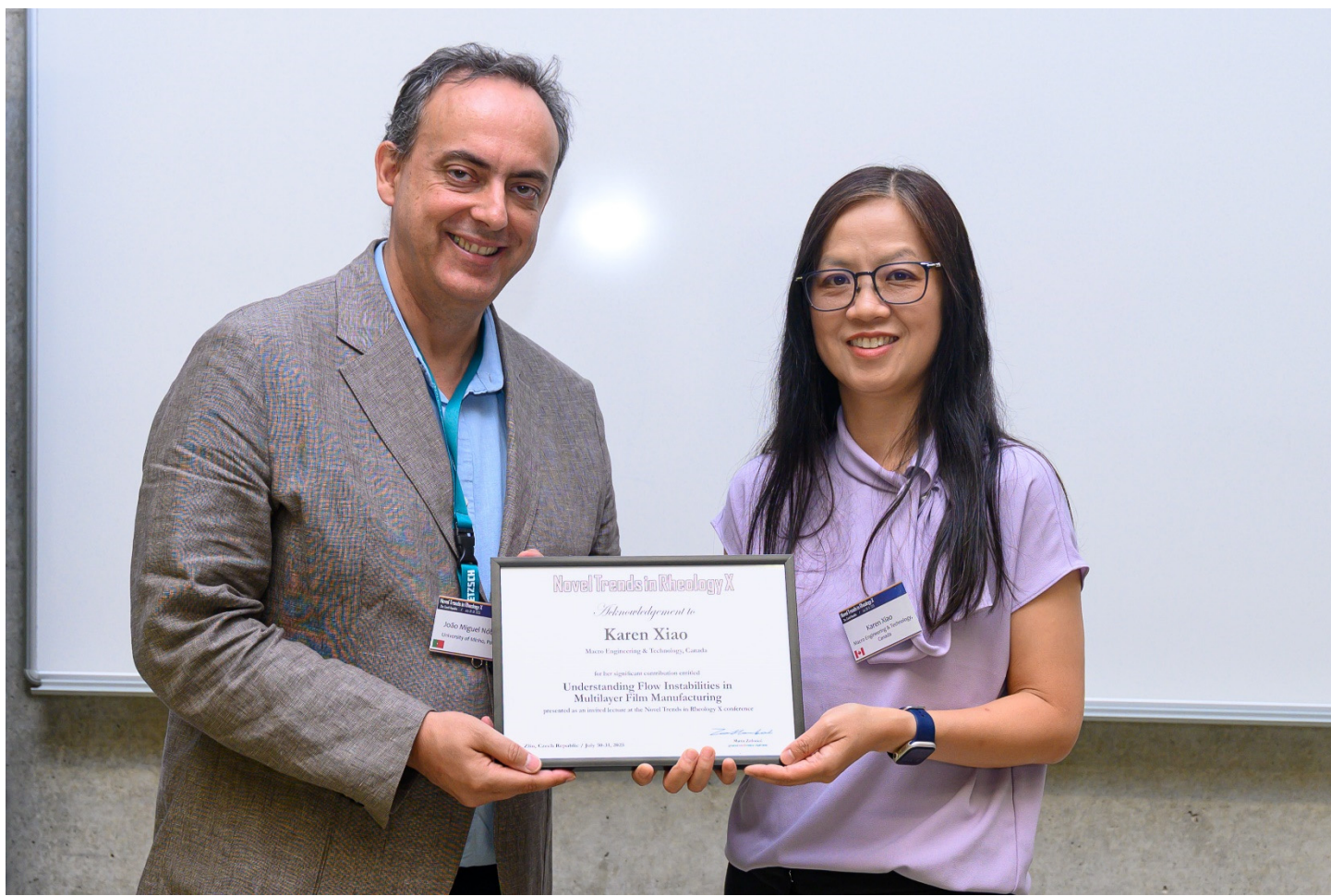


Figure 5 Karen Xiao (right) receiving the certificate from João Miguel Nóbrega (left) for lecture "Understanding Flow Instabilities in Multilayer Film Manufacturing".



Figure 6 Dietmar Auhl (right) receiving the certificate from João Miguel Nóbrega (left) for lecture "High-Pressure Melt Flow Behaviour of Polymer Composites in Experiments, Processing, and Modelling".



Figure 7 Masayuki Yamaguchi (left) receiving the certificate from Savvas George Hatzikiriakos (right) for lecture "Shear-Induced Crystallization of Polypropylene Blends".



Figure 8 Jaap den Doelder (left) receiving the certificate from Savvas George Hatzikiriakos (right) for lecture "Orientation of Polyethylene Films for Modulus Enhancement".



Figure 9 Zdeněk Starý (left) receiving the certificate from Dietmar Auhl (right) for lecture "Elasticity of Polymer Melts Filled with Glass Microspheres".



Figure 10 Manfred Wilhelm (left) receiving the certificate from Dietmar Auhl (right) for lecture "Analysis of the Fatigue Behavior of Solid Polymers and Elastomers via Fourier Transform of the Stress".



Figure 11 Laurence Noirez (right) receiving the certificate from Alan Jeffrey Giacomini (left) for lecture "Amazing Effects of the Mesoscopic Elasticity of Fluids: Application to Polymer Melts and Blood Plasma".



Figure 12 João Miguel Nóbrega (right) receiving the certificate from Jiří Vlček (left) for lecture "Enhancing Coupled Numerical Simulations of Viscoelastic Flows Through Physical Property Analysis".



Figure 13 Xiaohe Xu (right) receiving the Best poster award from Alan Jeffrey Giacomin (left) for his poster "A Novel Multifunction Die for Simultaneous Measurement of Steady-State Viscosity, First Normal Stress Difference and Flow Instability of Viscoelastic Liquids via Capillary Rheology".

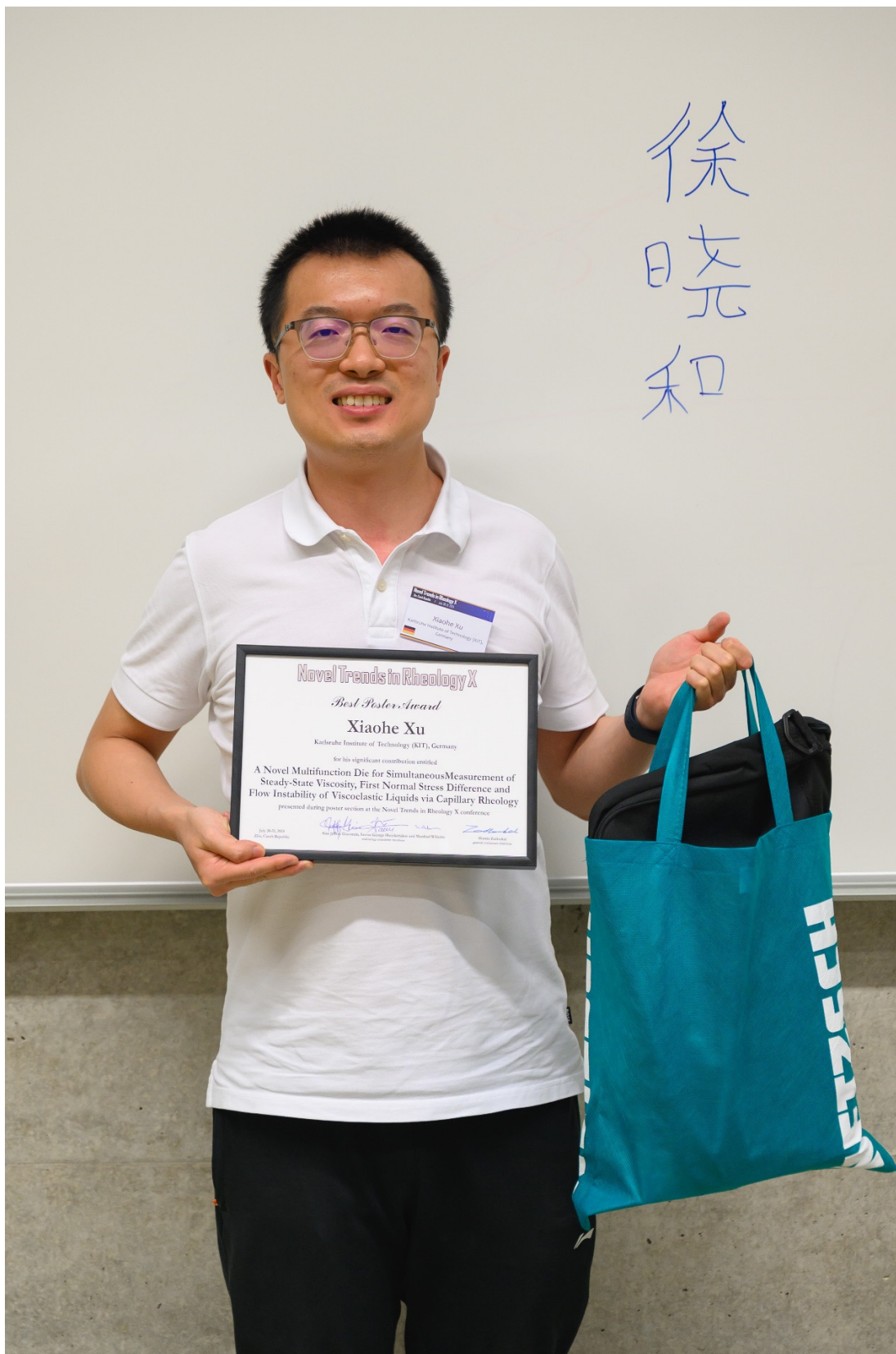


Figure 14 The winner of the competition for the best poster Xiaohe Xu for the work entitled "A Novel Multifunction Die for Simultaneous Measurement of Steady-State Viscosity, First Normal Stress Difference and Flow Instability of Viscoelastic Liquids via Capillary Rheology" with a prize from the main sponsor of the conference, NETZSCH.



Figure 15 Dinner.



Figure 16 Poster section.



Figure 17 Exhibition.



Figure 18 Conference room.



Figure 19 Refreshment.



Figure 20 Registration.



Figure 21 Karen Xiao plays a piece by Frédéric Chopin on the piano during a conference break.