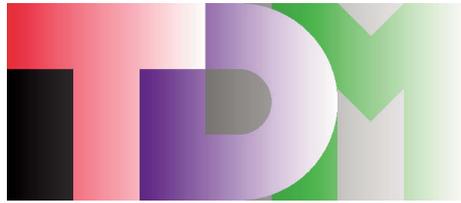


The 7th International Conference on Mechanics of Time-Dependent Materials

PORTOROZ, SLOVENIA
SEPTEMBER 5 – 11, 2010



The MTDM'2010 Conference was held September 5 through September 11, 2010 in Portoroz, Slovenia. As a regular event in a series of conferences on mechanics of time-dependent materials, this year the Conference was organized by the University of Ljubljana, Slovenian Society of Rheology and Institute for Sustainable Innovative Technologies (iSIT) in coordination with the journal «Mechanics of Time-Dependent Materials». The Conference thematic was closely related to constitutive, time- and rate-dependent behavior of all materials. Works dealing with modeling and experimental aspects of the subject area were of interest as well. The presentations were organized in the form of six symposia each of which was introduced with a key note lecture representing the area of expertise of the particular session. In addition to that, three plenary lectures entirely representing current state of mechanics of time-dependent materials were delivered. Industrial prospective was presented by dr. Giorgio Greening, the BASF Aktiengesellschaft Vice-president, while scientific part was introduced by Prof. Rajagopal Kumbakonam from Texas Transportation Institute, USA. Also it

was a great honour that the renowned Prof. Robert F. Landel (one of famous WLF Equation authors) agreed to attend the conference. His address on historical review drew a line under the sequence of plenary lectures.

Symposium 1: Durability of polymer matrix composites

Recently polymer matrix composites have been used in primary structures of airplanes, ships, spacecrafts, and used as biomaterials, etc. All these applications require highly reliable long-term operation. Therefore, it is essential to assess the reliability of the composite structures subject to long-term creep and fatigue loadings and environmental conditions (temperature, moisture absorption, etc.). The symposium was opened with the key note lecture “Creep behavior of fiber reinforced thermoplastics” presented by Prof. Satoshi Somiya and was mostly focused on composite materials mechanical properties dependency on the mentioned factors.

Symposium 2: Medical plastics

In the past few years the state of health of the population has been one of the top priorities of the European Union. As a result of the above, an intense pressure has been applied on intensifying research and innovation in the area of medical application of plastics. This means that at present it is not enough for the medical devices to be safe, reliable and biocompatible only. They



Figure 1:
Discussion on possible collaboration within The 7th European Framework Research Program. Introduction by Primož Pristovšek.

are also required to be more effective, intelligent and multifunctional. The key note lecture “Recent advances of magnetic materials in hyperthermia” was delivered by Prof. Natalia Kazantseva. Other presentations covered different angles of research and innovation in medical plastics application from bone surgery through plasma treatment to abolishment of tumour growth. Despite different focus of attention, they all share the same goal – to improve quality of medical care.

Symposium 3: Modeling and thermodynamics of nonlinear viscoelastic and viscoplastic materials

The symposium was focused on the current understanding in modeling and thermodynamics of time dependent phenomenon looking at the developments that have been made in the study of viscoelastic and viscoplastic materials at finite deformations. The subject is broad and has touched many fields from the study of manufacturing with polymers to blast induced traumatic brain injury, and has seen many rebirths of interest with example applications in multi-scale modeling and simulation, life prediction, development of polymer-based nano-materials and structures, modeling shape memory polymers, and characterizing and modeling of biological materials. As research on these and other applications has progressed, so has our overall fundamental understanding and modeling capabilities. Two keynote lectures - “Nonlinear viscoelasticity of amorphous polymer solids” and “Two-phase models in viscoelastoplasticity of semicrystalline polymers” – given by James M. Caruthers and Aleksey Drozdov respectively provided a forum to share and disseminate this growth of understanding.

Symposium 4: Emerging methodologies and materials characterization

This short symposium highlighted examples of how new technologies (including computer simulations) play a key role in advancing our knowledge and use of time-dependent materials in science, engineering, medicine and health. The keynote lecture “Predicting the response of aqueous foams” by Prof. Simon Cox gave a broad overview of aqueous foams and their use in domestic and industrial applications. Various mechanisms which model the time-evolution of foams, and capture the complex nature of foam

rheology, were described. Other talks were dedicated to flows of organic coatings and their rheometrical characterization, measurement and simulation of the time-dependent structure of biomolecules with applications to medicine and health and the modeling of exact continuous spectra as opposed to approximate line spectra in linear viscoelasticity

Symposium 5: Relaxation phenomena in glassy polymers

There is still much about the molecular physics and thermodynamics of glassy polymer that is not well understood. Glasses are metastable phases, the glassy state being dominated by inherently non-linear and non-exponential structural relaxation phenomena, and the glass transition is a relaxation kinetics-dominated process. The present session aimed to illustrate recent results on relaxation phenomena occurring in glassy polymers subjected to complex pressure/temperature, mechanical and concentration histories. The key note lecture “Isobaric PVT behavior of poly(carbonate)” by dr. Luigi Grassia dialed with a brand new approach to the kinetics of glass transition. It was shown that the pressure, volume, and temperature (PVT) data obtained on several amorphous polymers can be reliably predicted in the region of the alpha-relaxation. Furthermore, the session covered some aspects concerning the relaxation phenomena of “perturbed glasses” and the recovery behavior of epoxy resins was described.

Symposium 6: Post-crystallization and physical ageing defining mechanics and lifetime of polymers

The fact that polymers are dynamic materials often changing their properties over time is important for material selection as well as for component design in technical applications, but even in seemingly simple areas like food packaging. While physical ageing dominates the long-term performance of glassy polymers, post-crystallization effects on different levels will define the behavior of semicrystalline polymers. These changes are determined by three groups of factors: intrinsic polymer structure, processing parameters, and thermal exposure of the final component. A special challenge is presented by the complex structural nature of modern materials like polymer blends and nano-



Figure 2:
Participants of the
MTDM'2010 Conference at
the viewpoint to the Big
Valley near Skocianska
Jama.

composites, where constraint factors resulting from small length scales in the structure will further affect the changes. As a consequence of temperature dependent mobility, it is also not always possible to use time-temperature superposition for accelerated studies of these ageing processes. The presentations assembled for this symposium represented both fundamental and application-oriented aspects of ageing processes for a number of polymeric materials, clearly pointing out the importance of a profound understanding of the related processes for reliably predicting long-term stability and lifetime. In the keynote lecture "Fracture mechanics based lifetime assessment of PE pressure pipes – a review of test methodologies and concepts for failure prediction" given by prof. Reinhold W. Lang various test methodologies and concepts for lifetime assessment accounting for the phenomenon of slow crack growth as primary long-term failure mechanism were reviewed. The speech was focused on a novel concept for lifetime and safety assessment of polyethylene pressure pipes for arbitrary installation conditions based on modern methods of fracture mechanics.

The conference was an ideal venue for researchers, students and industrials for fruitful experience exchange in variety of fields. It gave also a great opportunity to deliver scientific messages to the technical and professional community and to promote new ideas across the audience in an effective manner.

It is appropriate to mention that the next International Conference on Mechanics of Time-Dependent Materials will take place in 2012 in Japan. Another meeting in this spirit is annually organized International Workshop on Advances in Experimental Mechanics, which takes place in Grand Hotel Bernardin, Portoroz, Slovenia each third week of August.

Finally, MTDM'2010 committee would like to acknowledge Ingenieurgesellschaft für technische Berechnungen mbH, Odelo Slovenija d.o.o., Interling Holding d.o.o., Thermo Scientific, Jozef Stefan International Postgraduate School, Vivapen d.o.o., Radenska d.d. and Acron as sponsors for their contribution in the conference organization.

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