



REPUBLIC OF SLOVENIA
MINISTRY OF EDUCATION,
SCIENCE AND SPORT



Investing in your future

OPERATION PART FINANCED BY THE EUROPEAN UNION
European Social Fund

PROCESSING OF POLYMER MATERIALS, THEIR PROPERTIES AND PRODUCT QUALITY



WORKSHOP

11 - 13 NOVEMBER 2014

The operation is partially financed by the European Union, through the European Social Fund and by the Ministry of Education, Science and Sport. The operation is implemented in the framework of the Operational Programme for Human Resource Development for the Period 2007-2013; 3rd Priority Axis: "Development of human resources and of life-long learning"; Activity 3.3 "Quality, competitiveness and responsiveness of higher education."

Internationalisation of the Polymer Technology College

The workshop Processing of Polymer Materials, their Properties and Product Quality is conducted within operation "Internationalisation of the Polymer Technology College", which was approved in the Public tender for co-financing activities in years 2013-2015, which foster the internationalisation of higher education (OG RS, no. 63/2013, from 26 July 2013).

The objectives of the operation are:

- Employment of a foreign expert (Klasius 4 or 5) for a period of six months. The employee will participate in the pedagogical and research activity of VŠTP
- Hosting nine guest lecturers at VŠTP. By November 2014 five guest lecturers already held their lectures at VŠTP
- Preparation and conduct of 2 international workshops for students
- Preparation and release of multilingual information brochure, namely in English, German and Croatian

Responsible person of the applicant:

- dr. Silva Roncelli Vaupot

Duration:

- 1 December 2013 - 30 June 2015

Programme:

- Operational Programme for Human Resource Development for the Period 2007-2013; 3rd Priority Axis: Development of human resources and of lifelong learning; Activity 3.3. Quality, competitiveness and responsiveness of higher education

Dr. Stephan Laske

Biopolymer Processing

Prof. Stephan Laske studied polymer engineering and science at the Montanuniversität Leoben and finished there also his Ph.D. studies in the field of polymer processing. Since 2009 he is an Assistant Professor at the Chair of Polymer Processing and the Head of the Compounding working group.

His main research focus is compounding of thermoplastic polymers (esp. nanocomposites), processing of biopolymers and processing related topics such as in-line quality control and intelligent processing by active dies.

Prof. Laske published 18 peer reviewed publications, 2 books and 4 book chapters, owns 2 patents and has more than 80 contributions to international conferences.

Abstract: In the last decade, biopolymers are one of the most followed material class in the area of polymers. The reason for this are more or less ecological reasons and marketing driven considerations. Nevertheless, biopolymers are a very fascinating topic as they have a large diversity regarding carbon source, usability and end of life scenario. The processing of biopolymers is a mainly empiric story with many misunderstandings as people tried to process biopolymers with their usual process setting. The lecture deals with the main polymer processes and the specialties when processing biopolymers. Starting with the most important processes such as injection molding or extrusion, biopolymer characteristics are considered and prerequisites for processing of biopolymers shown.

Dr. Thomas Wilhelm

High Performance Polymers - Materials, Applications and Perspectives

Dr. Thomas Wilhelm received his Diploma (M.Sc.) in Chemistry and his Doctorate (Ph.D.) in Science in 1981 and 1986, respectively, both from the University of Kaiserslautern, Germany. He also graduated as MBA from University of Toronto, Canada, in 1998. During his professional career he served in various senior management functions for BLANCO GmbH + Co KG (Oberderdingen, Germany), Weidmann Plastics Technology GmbH (Rapperswil, Switzerland), Ensinger GmbH (Nufringen, Germany) and forteq Group (Nidau, Switzerland). He (co)authored 8 international publications and 17 patents, most of them in the field of polymers and their properties. Currently he is a freelance consultant and affiliated with stettlerpartners GmbH in Uster (Switzerland).

Abstract: High Performance Polymers occupy a small niche in the use of plastics where enhanced temperature stability and specific properties are required, justifying high costs and complex processing conditions. An overview of this class of polymers is presented with emphasis on commercially important materials, specific processing conditions and technologically demanding applications where these materials offer significant advantages compared to metals and other materials. As a consequence, high performance polymers can be found more or less ubiquitous in modern technology. Finally, possible future trends are discussed - indicating that the field of high performance polymers will constantly keep moving and will play a viable role in further stretching the boundaries of plastics use.

Ing. Karel Soukup, Ph.D.

Recent Advances in Polymer Nanofibers

Ing. Karel Soukup, Ph.D., was born in 1978. From 1997 to 2002 he attended the Master's study program at the Institute of Chemical Technology Prague, the Faculty of Chemical Technology. In 2002 he continued his post-graduate education at the Institute of Chemical Process Fundamentals, the Academy of Sciences of the Czech Republic. He acquired his Ph.D. in 2006. Since 2006 he is employed as a scientist at the Institute of Chemical Process Fundamentals. In 2008 he conducted a stage abroad at the Marie Curie Research Fellowship at the Central Mining Institute in Katowice in Poland. His research activities encompass: 20 publications, 2 chapters in a book, 1 patent, 50 conference contributions (lectures and poster presentations, 1 plenary lecture) and 2 research reports.

Abstract: In the past few years, the polymer nanofibers have attracted a plenty of attention due to their extraordinary potential, both in technical areas and in medical applications. Among possible utilization of nanofibers are filter media for submicron particles in separation industry, advanced nanofibrous membranes, composite reinforcement and structures for nanoelectronic machines, defensive systems (protective clothing), catalysis and medical applications (drug delivery and tissue engineering). Polymer nanofibers can be prepared by a number of techniques like template synthesis, phase separation, self-assembly or drawing. However, electrospinning as a versatile method for producing nanofibers through an electrically charged jet currently represents not only the most straightforward but also the cheapest way for polymer nanofibers production even on industrial scale. Produced electrospun nanofibrous mats reveal outstanding properties such as high macroporosity, high surface to volume ratio, low density of layers and tunable surface morphologies.

Dr. Tadeja Primožič Merkač

Product Quality

Dr. Tadeja Primožič Merkač studied Mathematics and Physics at the Faculty of Education, in cooperation with the Faculty of mathematics and Physics.

In 2000 she started her doctoral studies at the Faculty of Mechanical Engineering, where she studied Mechanical Engineering.

In her professional career she has gathered various work experience in the field of education and industry.

Among others she worked as a teacher of mathematics and physics, as the head of calibration laboratory and a director of a company.

Currently she is the director of metrology and defectoscopy laboratory at Sistemska tehnika d.o.o., and the director and consultant of company Kako d.o.o.. Since February 2012 she is also the v.d. dean of college Visoka šola Ravne.

Abstract: Quality of a product is a group of features and characteristics of a saleable good which determine its desirability and which can be controlled by a manufacturer to meet certain basic requirements. Most businesses that produce goods for sale have a product quality or assurance department that monitors outgoing products for consumer acceptability. Quality needs to be defined firstly by the customer and accepted by the manufacturer in terms of features, characteristics or specifications which vary from product to product. Next to customer's needs, requirements provided in standards, and requirements relating to product safety and health hazards provided for in the statutory and regulatory requirements, should be considered. The specifications should show the quality standard demanded by the customer in clear and precise terms. Every dimension should have realistic tolerances and other performance requirements should have precise limits of acceptability so that the production team can manufacture the product strictly according to specification.

Dr. Ing. Jiří Kotek

Mechanical Testing of Plastics

Dr. Jiří Kotek was born in 1971. He is employed at the Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, where he works as a senior scientist. He is also the Head of Otto Wichterle Centre of Polymer Materials and Technologies and the deputy director of the Institute.

His research interests are: the interrelations between structure and mechanical behaviour of polymers, their blends and composites; fracture mechanics; recycling of polymers. During his professional career he has prepared 50 scientific papers in impacted journals and more than 100 communications at international conferences.

Abstract: Information on mechanical properties of plastics is essential for several purposes including design, specification, failure analysis, optimizing material formulations and processes, and, last but not least, for quality control. The lecture gives an overview of the most important mechanical parameters together with corresponding methods for their assessment. A special attention is paid on the effects of structural parameters, test conditions and test pieces production on resulting properties. The lecture is primarily focused on mechanical characteristics derived from an universal testing machine and from a dynamic mechanical analyzer. A demonstration in laboratory will be also given.

Dr. Lidija Slemenik Perše

Rheological Properties of Polymers

Dr. Lidija Slemenik Perše is a researcher at the National Institute of Chemistry in Ljubljana.

She received her Ph.D. degree at the University of Ljubljana, Faculty of Chemistry and Chemical Technology.

Her primary research interest is rheology, especially rheology of coatings, suspensions and sol-gel transition. Her research is focused also on spectral selectivity of solar paints and surface morphology of thin coatings.

She published over 120 publications including 25 scientific papers in international journals, several papers at international conferences, 4 chapters in a scientific book and 1 patent application.

Abstract: Rheology is the study of deformation and flow. In practice, it is principally concerned with extending continuum mechanics to characterize flow of materials that exhibits a combination of elastic, viscous and plastic behavior by properly combining elasticity and (Newtonian) fluid mechanics. The knowledge of rheological properties affects processing (design, costs, production rate, ...), product quality (surface distortions, anisotropy, strength, structure development, ...), as well as the end use of the product (food texture, product pour, motor-oil function, ...). The goal of the lecture is to present the basics of rheology and rheometry, the kinds of flow and deformation effects exhibited by complex systems (polymers) and to present different information obtained from the measurements of the rheological properties of polymers.

Janez Navodnik

Composite Materials and Technologies

Janez Navodnik, BSc. Chemistry, is renowned for more than 30 years of experiences with technologies of polymer materials processing. He is the director of the company Navodnik and Plasttechnics Cluster Slovenia and he is engaged in consulting and education in the field of plastics processing, new and advanced materials and technologies and he coordinates different companies in common projects. He is the editor and author of the majority of articles in the PlastForma magazine, as well as the author of numerous independent publications, the handbook Plastic-Toolmaker and the book Nanotechnologies – materials and technologies for the future.

Abstract: The seminar will address the remarkable characteristics of composite materials and their use in different interesting products. It is generally believed that plastics processing is necessarily linked to expensive machines and tools, otherwise it is uneconomic. This is entirely true for cheap extruded and injection-moulded products. The penetration of injection-moulded and extruded plastics is very successful due to low price and unlimited possibilities of processing, but the majority of materials is 5 to 10 times less stiff than steel. It is therefore surprising that many low-series procedures demanding much lower investments have become established only to a small extent in Slovenia while they are increasingly gaining ground globally. Namely, they enable the manufacture of products with characteristics, shapes and dimensions that are not achievable by high-series procedures. Composites are dominant in this field. Composites are composed of fibres with high stiffness which is the highest among other materials and consequently they are used for complex and expensive products such as airplanes, cars and sports equipment.

Dr. Dragan Kusić

Monitoring and Control of Injection Moulding Process

Dragan Kusić received his B.S. degree in 2008 and Ph.D. degree in 2014 both from the Faculty of Electrical Engineering and Computer Science, University of Maribor. In 2009, he joined TECOS, the Slovenian Tool and Die Development Centre, where he first worked as a doctoral researcher from industry cooperation with Faculty of Electrical Engineering and Computer Science (University of Maribor) and also Faculty of Mechanical Engineering (University of Ljubljana) in his expertise field of control systems design. From 2010 he is also a member of The Institute of Measurement and Control in London, UK. In recent years, he has been working as a coordinator and/or member on several applied R&D domestic and international research projects. He has practical skills in mechatronics, polymer testing, non-destructive testing, embedded systems development, construction, installation and system management of automated industrial processes etc. Dr. Kusić is the owner of one patent and appeared as an author or co-author of several scientific and conference articles.

Abstract: Nowadays the moulds that produce the injection moulded parts are often constructed from the modified CAD model data, which includes the incorporation of shrink factors, parting lines, draft angles etc. High amount of practical knowledge is used to reduce thick and/or thin material areas and possible urgent inclusion of features to reduce additional twisting and warping of the produced parts. Following this few simple rules, the moulds for non-technical parts can normally be constructed and produced in order to obtain good quality parts in practice, without any need for subsequent modifications. Now we are witnessing everywhere that complexity of technical parts is increasing in terms of higher accuracy that is shortly related to final quality of such parts. Once the quality is reached the delivery requests must be met. This eventually means that parts need a regular or periodic inspection and continuous quality control of the injection moulding process in order to fulfil all requirements. Therefore the aim of this lecture is to highlight key things in terms of monitoring and control of injection moulding process that are important for parts quality assurance.

Dr. Christian Kukla

Additive Manufacturing, Rapid Prototyping: Materials, Processes and Principles, Products

Dr. Christian Kukla began his study in 1981 at the Montanuniversität Leoben (MUL), where he studied "Plastics Engineering". He concluded his studies in 1987 and at the same year enrolled in doctoral study, which he concluded with a doctoral thesis in 1994.

Since then he has gathered various work experience. From 1994 to 1997 he was the Head of the Department for Application Engineering at Battenfeld Kunststoffmaschinen GmbH. From 1997 to 1999 he was employed as the Head of the group for Ultraprecision Engineering at the WBFG / Fachhochschule Wiener Neustadt (FHWN). Since 2000 he is working at the Industrial Liaison Department at MUL.

His lectures and training include:

- 'Composites' at MUL
- 'Production Technology' at FHWN
- 'Materials' at FHWN
- 'Spacial Materials for Microengineering' at FHWN
- 'Werkstoffveredelung' at FHWN
- 'Materials and 'Production Technology' for FH St. Pölten

Abstract: Additive Manufacturing (AM) (or 3D Printing as often referred to in the press) produces parts by adding layers of material to build up an object. It was initially developed in the late 1980's / early 90's as a group of processes to produce prototypes quickly for the product development world. Hence, it was originally known as Rapid Prototyping. In 1997 it was proposed that AM could economically manufacture end-use parts in lots up to 6,000. Since then much attention has been devoted to transforming these processes from prototyping to manufacturing. In the recent years some important patents are expiring. Thus, its importance in the manufacturing arena will also continue to grow at a rapid rate (currently about 26% per annum). Therefore this lecture shall give an introduction into this interesting area showing advantages and opportunities of AM.

Mag. Art. Johannes Puinbroek

“Thinker&Maker: Design Thinking Process (Fablabs)”

Mag. Art. Johannes Puinbroek was born in 1968 in Amsterdam. In 1979 he moved to Austria. He conducted his studies of Product Design at the University of Applied Arts Vienna. Since then he has continued his education by attending and participating in various national and international symposiums, trainings and seminars. In his professional career he has gathered various work experience in the field of design and education. He has designed various products and won several rewards. Currently he is working at Euregio Höhere Technische Bundeslehr - und Versuchsanstalt Ferlach as a lecturer of several subjects from the field of design.

Abstract: Mag. Johannes Puinbroek's main topics on the presentation “Thinker & Maker: Design Thinking Process (Fablabs)” are:

- 1.) Presentation of the Euregio HTBLVA Ferlach
- 2.) Definition of design and internal varieties of design
- 3.) Design development
- 4.) „Maker“ – the way to design
- 5.) Design thinking
- 6.) Design – a qualitative approach to „Startup“

Timetable

Tuesday, 11. 11. 2014

8:15 - 9:45	Biopolymer Processing STEPHAN LASKE, Montanuniversität Leoben, Austria
10:00 - 11:30	High Performance Polymers - Materials, Applications and Perspectives THOMAS WILHELM, stettlerpartners, Switzerland
13:00 - 14:30	Recent Advances in Polymer Nanofibers KAREL SOUKUP, Institute of Chemical Process Fundamentals, Czech Republic
14:45 - 16:15	Product Quality TADEJA PRIMOŽIČ MERKAČ, Visoka šola Ravne na Koroškem, Slovenia

Wednesday 12. 11. 2014

8:15 - 9:45	Mechanical Testing of Plastics JIŘÍ KOTEK, Institute of Macromolecular Chemistry, Czech Republic
10:00 - 11:30	Mechanical Testing of Plastics JIŘÍ KOTEK, Institute of Macromolecular Chemistry, Czech Republic
13:00 - 14:30	Rheological Properties of Polymers LIDIJA SLEMENIK PERŠE, Institute of Chemistry Slovenia, Slovenia
14:45 - 15:45	Presentation of ideas from the contest "New Bioplastic Products" Students of VŠTP, FD and MFDPŠ
16:00 - 17:30	Monitoring and Control of Injection Moulding Process DRAGAN KUSIČ, TECOS - Slovenian Tool and Die Development Centre, Slovenia

Thursday, 13. 11. 2014

8:15 - 9:45	Composite Materials and Technologies JANEZ NAVODNIK, Plasttechnic Cluster Slovenia, Slovenia
10:00 - 11:30	Additive Manufacturing, Rapid Prototyping: Materials, Processes and Principles, Products CHRISTIAN KUKLA, Montanuniversität Leoben, Austria
13:00 - 14:30	"Thinker&Maker: Design Thinking Process (Fablabs)" JOHANNES PUINBROEK, Euregio Höhere Technische Bundeslehr - und Versuchsanstalt Ferlach, Austria
14:45 - 16:15	"Thinker&Maker: Design Thinking Process (Fablabs)" JOHANNES PUINBROEK, Euregio Höhere Technische Bundeslehr - und Versuchsanstalt Ferlach, Austria

