



# International Conference on Polymer Processing in Engineering

Galati, Romania  
September 21-23, 2017



## **Conference Chair**

**Loredana SANTO**

University of Rome Tor Vergata, Italy

## **Technical Program Chair**

**Catalin FETECU**

Dunarea de Jos University of Galati, Romania

## **Scientific Committee Chair**

**Felicia STAN**

Dunarea de Jos University of Galati, Romania





## **Scientific Committee**

Antoniac Iulian (Romania)	Istvan Albert (Romania)
Balan Corneliu (Romania)	Jinescu V. Valeriu (Romania)
Balc Nicolae (Romania)	Lopresto Valentina (Italy)
Banea Mariana (Brasil)	Martin-Martinez Jose Miguel (Spain)
Banu Mihaela (USA)	Munteanu Corneliu (Romania)
Bociaga Elzbieta (Poland)	Nagit Gheorghe (Romania)
Boschetto Alberto (Italy)	Nedelcu Dumitru (Romania)
Cardon Ludwig (Belgium)	Opran Constantin (Romania)
Celis Jean-Pierre (Belgium)	Palade Liviu Iulian (France)
Cerbu Camelia (Romania)	Quadrini Fabrizio (Italy)
Coseri Sergiu (Romania)	Marsavina Liviu (Romania)
Davim Paulo (Portugal)	Musat Viorica (Romania)
Doicin Cristian (Romania)	da Silva Lucas (Portugal)
Durmus Ali (Turkey)	Simionescu C. Bogdan (Romania)
Earar Kamel (Romania)	Slatineanu Laurentiu (Romania)
Eliezer Dan (Israel)	Sover Alexandru (Germany)
Fetecau Catalin (Romania)	Stan Felicia (Romania)
Hadar Anton (Romania)	Serban Alexandru (Romania)
Ibanescu Constanta (Romania)	Thanumoorthy R Ram Kuduva (USA)
Iovu Horia (Romania)	Zgherea Gheorghe (Romania)

## **Organizing Committee**

Fetecau Catalin	Susac Florin
Stan Felicia	Busila Mariana
Serban Alexandru	Valcu Herbei Elena
Rusu Carmen Catalina	Stanciu Nicoleta Violeta
Sandu Ionut Laurentiu	Roscullet Razvan



## **Foreword**

Polymer Processing in Engineering (PPE) Conference, held every two years, aims to gather academic researchers and industrial partners involved in the field of polymers.

The PPE 2017 conference covers all of the important areas in the field, from state-of-the-art research and development to characterization, fabrication, technology development, numerical modeling and many new and emerging applications of polymeric materials.

The Polymer Processing in Engineering Proceedings is scheduled to be published in the periodical Key Engineering Materials.

## **Main Topics of the Conference**

Members of industry and scientific community are invited to contribute with presentations on any of the conference topics. Specific topics include, but are not limited to:

- Polymer processing, rheology & rheometry
- Biopolymers & biotechnologies
- Nanopolymers & nanotechnologies
- Polymers, functional surfaces and bio-material interfaces
- Properties of polymers, including thermal, surface and adhesion
- Surface modification of polymers
- Green polymers, reprocessing & recycling
- Mechanical behavior of polymers and polymer composites
- Fracture mechanics of polymers & polymer composites
- Reliability & testing methods
- Product, mould design, & manufacturing processes
- Applications of polymers in industry
- Computational polymers & polymer composites

# **Polymer Processing in Engineering Conference**

**Galati, 21-23 September 2017**

---



## **Welcome**

Dear Colleagues,

As the organizers of the PPE2017, and on behalf of the entire polymer processing research and education group at Dunarea de Jos University of Galati, we welcome you to Galati.

A successful conference depends on many dedicated conference organizing committee, technical program committee, symposium organizers, authors, and reviewers. We would like to thank all of the authors for their technical papers and oral presentations, the host Organizing Committee, the Conference Coordinating Committee, the PPE Scientific Committee, and the conference sponsors.

We would also like to thank our keynote speakers, Valentina Lopresto (University of Naples Federico II, Italy), Mihaela Banu (University of Michigan, Ann Arbor, USA), and Bogdan C. Simionescu ("Gh. Asachi" Technical University of Iasi & "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania) for sharing their experience and insight into the challenges of polymer processing and engineering.

We hope you enjoy your visit to Dunarea de Jos University of Galati, and find the conference useful in expanding your technical knowledge, as well as your network of contacts within the polymer processing research community. Enjoy the conference!

Loredana SANTO  
PPE 2017 Conference Chair

Catalin FETECAU  
PPE 2017 Technical Program Chair



## **Keynote Speech**

### **Low Velocity Impact Behaviour of Composite Laminates: Damage Investigation and Residual Strength**

**Speaker:** Valentina Lopresto, University of Naples "Federico II", Italy

### **Ultrasonic Welding of Polymer Composites**

**Speaker:** Mihaela Banu, University of Michigan, Ann Arbor, USA

### **Polymers Designed for Drug/Gene Delivery and Tissue Engineering**

**Speaker:** Bogdan C. Simionescu, Department of Natural and Synthetic Polymers, "Gheorghe Asachi" Technical University of Iasi & "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

## **Industrial Presentation**

### **Characterizing Polymer Degradation During Processing Using Multi-Detector GPC and Rheometry**

**Speaker:** Irina Stan, Malvern Instruments, UK

**Co-authors:** Shona Murphy, Mark Pothecary, Malvern Instruments, UK

## **Low Velocity Impact Behaviour of Composite Laminates: Damage Investigation and Residual Strength**

**Speaker:** Valentina Lopresto, University of Naples "Federico II", Italy

**Abstract:** Composite materials are largely used in space vehicles, aircraft, modern transport vehicles and light weight structures. However, they are susceptible to impact damage due to the weak bonds between the plies. Low velocity impacts may occur during manufacture, maintenance, by careless handling and life service, and they're dangerous for a composite structure because of the not simple damage mechanisms and their complex interaction. Moreover, the damage is not always a visible damage even if it could be present between the internal plies [1]. This is one of the most potentially dangerous aspect in the impact response of composite structures: the hardly detectable damage, even when considerable strength and rigidity losses have occurred.

The consequence of an impact damage is the loss of load carrying capability which can fall considerably down the design thresholds, leading to catastrophic failures. Generally, the low velocity impact induced damage can substantially affect the mechanical behaviour of composite structures. It is taken into account in composites design by introducing experience driven safety margins and by strongly reducing the material allowables. As a consequence of this approach, dictated by the lack of knowledge of impact induced failure mechanisms, composite structures are usually over- dimensioned.

To completely understand the impact damage phenomenon on composite materials, a large campaign of low velocity impact tests was carried out and the contemporary, and/or subsequent, non destructive and destructive damage investigations, have been done on specimens made of different fibre/matrix combinations. The impact loads were varied growing up to complete penetration, in order to have information about the damage onset and propagation. Semi empirical models for the right evaluation of the influence of the involved parameters, were studied and validated at the final aim to predict the residual compression strength. Since its importance, a considerable amount of research work has been devoted to the investigation of the residual strength of composite structures after impact [2-4]. It is due to the importance to know if the panel in service, mounted on a structure, can continue to work or if it is necessary to replace the part. At this aim, CAI tests were performed by a new and more affordable equipment recently designed at University of Naples.

The impact tests were conducted in the traditional way, by a falling weight machine equipped with an instrumented steel impactor, with hemispherical nose 19.8 mm in diameter. The internal damage was investigated by fractography or the common Ultra Sound technique, as well as innovative technologies such as holography. Moreover, since the environmental conditions, critical for structures made of composite material, are related to low temperatures, especially in presence of dynamic loads, the impact tests were carried out at room and at the low temperatures of -25°C and -50°C, thanks to a thermal chamber. The final goal is to fully understand the influence of the impact induced damage on the mechanical behaviour of composite components, independently of the constituent materials and the loading conditions.

### **References**

1. G. Caprino, V. Lopresto, The significance of indentation in the inspection of carbon fibre-reinforced plastic panels damaged by low-velocity impact, *Compos. Sci. Technol.*, 60 (2000) 1003-1012.
2. S. Abrate, Impact on laminated composites: recent advances, *Appl. Mech. Rev.*, 47(1994) 517- 544.
3. G. Caprino, Residual strength prediction of impacted CFRP laminates, *J. Compos. Mater.*, 18(1984) 508- 518.
4. W.J. Cantwell, J. Morton, The impact resistance of composite materials - A review, *Composites*, 22 (1991) 347-362.



## **Ultrasonic Welding of Polymer Composites**

**Speaker:** Mihaela Banu, University of Michigan, Ann Arbor, USA

**Abstract:** Advanced materials enable extensive development of autonomous electric and hybrid cars. Replacing conventional materials such as cast iron with aluminum, magnesium, or polymer composites can lead to a weight reduction of 50% in vehicle's body and chassis and therefore reduce a vehicle's consumption.

Short carbon fiber composites are among the candidates to be used in the new generation of cars with great potential of mass production and low cycle time of fabrication. The development of new lightweight materials with high specific strength requires robust, performant and portable joining technologies. Among other joining processes, ultrasonic welding of polymer composites is characterized by the lowest cycle time (less than 1 sec.), robustness, efficiency and portability.

This presentation will focus on investigations of ultrasonic welding of short carbon fiber composites using experimental and computational, multi-scale approaches. The presentation will be focused on analysis of the behavior of short carbon fiber nylon composites under ultrasonic welding as well as modeling of this process and its performance.





## **Polymers Designed for Drug/Gene Delivery and Tissue Engineering**

**Speaker:** Bogdan C. Simionescu, Department of Natural and Synthetic Polymers, "Gh. Asachi" Technical University of Iasi & "Petru Poni" Institute of Macromolecular Chemistry, Iasi, Romania

**Abstract:** Different macromolecular and supramolecular compounds including micelles, polymersomes, nano- and microparticles (-capsules/-spheres), molecular imprinting polymers, dendrimers, nanogels, hydrogels and interpenetrated polymer networks have been developed and tested as potential systems of interest for biomedical applications. To gain further clinical importance the new materials (resulting in preformed or *in-situ* forming biomedical systems) must provide not only high physicochemical and biological performances but also processing ability (required by the manufacturing techniques). These demands – and especially the last one – often imply combination of natural and synthetic polymers (blends, block/graft copolymers, bioconjugates, interpenetrating networks, etc.), while improved performances may be mainly achieved by composite materials (inorganic/organic, biocomposites). The targeted application site or cargo may require specific material category (biodegradable, bioresorbable), dimension scale (micro/nano size) and topographic characteristics. Some of the existing obstacles and limitations may be surpassed by combining systems and approaches from apparently different application domains. Thus, controlled drug delivery and its application in tissue engineering for tissue growth support and stimulation attracted much attention over the last decade, while combination of gene therapy and tissue engineering within a single system resulting in a powerful synergism of treatment options for regenerative medicine (scaffold mediated gene therapy) seems to be an alternative for tissue healing. While recent results make the domain very attractive, key issues are to be solved to develop technologies of potential clinical impact.

The presentation summarizes the history and challenges in the discussed domains, pointing on polymers as a possible solution to specific challenges, and outlines the current state of the art, focusing on the newest strategies to improve systems effectiveness and responsiveness (design keys, preparative approaches). Expected future directions are underlined.



## **Characterizing Polymer Degradation During Processing Using Multi-Detector GPC and Rheometry**

**Speaker:** Irina Stan, Malvern Instruments

**Co-authors:** Shona Murphy, Mark Potheary, Malvern Instruments

**Abstract:** It is well recognized that the bulk properties of a polymer such as strength, toughness and flexibility are strongly dependent on molecular properties such as molecular weight, chemical composition, and molecular structure (branching). Hence, if the molecular properties of the polymer or co-polymer change as a consequence of processing, for example, then it is likely that the final properties of the moulded product will vary from those expected of the virgin polymer. Two complementary tools for understanding the “Structure-Property-Processing” relationship of polymers are Gel Permeation Chromatography (GPC) and Rheometry, with the former providing information on polymer structure and the latter physical properties such as melt viscoelasticity, thermal behaviour and certain solid-state characteristics.

In this study, we demonstrate the combined use of multi-detector GPC, rotational rheometry and capillary rheometry for studying the impact of processing on polystyrene, poly(methyl methacrylate) and polycaprolactone.



## PPE 2017 Technical Program

### Thursday, September 21, 2017

Time	Event	Location
9:00 a.m. – 1:00 p.m.	<b>Registration</b>	Hall D
9:30 a.m. – 9:50 a.m.	<b>Welcome to PPE2017</b>	D 12
9:50 a.m. – 10:30 a.m.	<b>PPE 2017 Keynote</b> Low Velocity Impact Behaviour of Composite Laminates: Damage Investigation and Residual Strength <i>Speaker: Valentina Lopresto, University of Naples Federico II, IT</i> <i>Chair: Loredana Santo, University of Rome Tor Vergata</i>	D 12
10:30 a.m. – 5:00 p.m.	<b>Demonstrations, Malvern Instruments</b>	H 03
10:30 a.m. – 11:15 a.m.	Polymers, Functional Surfaces and Interfaces	D 12
11:15 a.m. - 11:45 a.m.	<b>Morning Break</b>	Hall D 1 <sup>st</sup> floor
11:45 a.m. – 12:30 p.m.	Processing and Testing of Polymers and Composites I	D 12
12:30 p.m. – 1:10 p.m.	<b>PPE 2017 Keynote</b> Ultrasonic Welding of Polymer Composites <i>Speaker: Mihaela Banu, University of Michigan, Ann Arbor, USA</i> <i>Chair: Elena Scutelnicu, Dunarea de Jos University of Galati</i>	D 12
1:15 p.m. – 2:15 p.m.	<b>Lunch</b>	Hall D 1 <sup>st</sup> floor
2:15 p.m. – 3:00 p.m.	<b>PPE 2017 Industry Presentation</b> Characterizing Polymer Degradation During Processing using Multi-detector GPC and Rheometry <i>Speaker: Irina Stan, Malvern Instruments, UK</i> <i>Chair: Mariana Ibanescu, Dunarea de Jos University of Galati</i>	D 12
3:00 p.m. - 3:45 p.m.	Processing and Testing of Polymers and Composites II	D 12
3:45 p.m. - 4:15 PM	<b>Afternoon break</b>	Hall D 1 <sup>st</sup> floor
4:15 p.m. - 5:30 p.m.	Green Polymers, Reprocessing & Recycling	D 12
7:00 p.m. - 9:00 p.m.	<b>Dinner</b> <b>HOTEL GALATI CENTRUM</b>	Meeting point Hotel Galati

**Polymer Processing in Engineering Conference**  
Galati, 21-23 September 2017



**Friday, September 22, 2017**

Time	Event	Location
9:00 a.m. – 10:00 a.m.	<b>Registration</b>	Hall D
9:00 a.m. – 12:00 p.m.	<b>Demonstrations, Malvern Instruments</b>	H 03
10:00 a.m. – 10:45 a.m.	Polymer Processing, Rheology & Rheometry	D 12
10:45 a.m. – 11:30 a.m.	<b>PPE2017 Keynote</b> Polymers Designed for Drug/Gene Delivery and Tissue Engineering <i>Speaker: Bogdan C. Simionescu, Department of Natural and Synthetic Polymers, "Gh. Asachi" Technical University of Iasi &amp; "Petru Poni" Institute of Macromolecular Chemistry, Romania</i> <i>Chair: Constanța Ibănescu, "Gh. Asachi" Technical University of Iasi</i>	D 12
12:15 p.m. – 2:15 p.m.	<b>Ceremony Doctor Honoris Causa</b> Academia Română - 150 de ani în serviciul Națiunii Române <i>Bogdan C. Simionescu</i>	Senate Hall Domneasca 47
3:15 p.m. – 6:15 p.m.	<b>Danube River Tour &amp; Lunch</b> (Boat leaves at 3:15 p.m.)	Meeting point Hotel Galati

**Saturday, September 23, 2017**

Time	Event	Location
10:00 a.m. – 12:00 p.m.	<b>Visit to Museum of History, Culture and Christian Spirituality of the Lower Danube</b>	Meeting point Hall D



## Symposium

### Polymers, Functional Surfaces and Interfaces

<b>Session:</b> Polymers, Functional Surface and Interfaces (Thursday, 10:30 – 11:15, D12)		
<b>Session chair:</b> <i>Laurentiu SLATINEANU, „Gheorghe Asachi” Technical University of Iasi</i>		
<b>Session co-chair:</b> <i>Catalin FETECAU, Dunarea de Jos University of Galati</i>		
<b>Paper #</b>	<b>Authors</b>	<b>Title</b>
PPE2017-01	Santo L., Quadrini F., Bellisario D., Polimeni A., Santarsiero A. <i>University of Rome Tor Vergata</i>	Variability of Mechanical Properties of Collagen Membranes Used in Dentistry
PPE2017-02	Bellisario D., Quadrini F., Santolim G., Tedde M. G., Caputo V., Spitalieri P., Sangiulio F., Santo L. <i>University of Rome Tor Vergata</i>	Effects of Micro-Textured Polystyrene Substrates by Compression Molding on Cell Adhesion and Proliferation
PPE2017-03	Marin L., Topala P., Patriche N., Tenciu M., <i>National Institute for Research and Development in Chemistry and Petrochemistry</i>	Polyurethane Nanocomposite Coating with Special Burning and Abrasion Proof Properties



## Symposium

### Processing and Testing of Polymers and Composites

<b>Session:</b> Processing and Testing of Polymers and Composites I (Thursday, 11:45 – 12:30, D12) <b>Session chair:</b> <i>Loredana SANTO, University of Rome Tor Vergata</i> <b>Session co-chair:</b> <i>Florin SUSAC, Dunarea de Jos University of Galati</i>		
PPE2017-04	Yurkin Y.V., Mansurova I.A., Belozarov V.S., Zlobina E.A., <i>Vyatka State University</i>	Morphological and Dynamic Mechanical Analysis of Vibration Damping Composite Material Based on Different Elastomers
PPE2017-05	Enăchescu G.L., Ștefănescu M.F., <i>University Politehnica of Bucharest</i>	Theoretical and Practical Solutions for Determining the Acoustic Properties of Polystyrene Composites Used as Insulating Panels
PPE2017-06	Slătineanu L., Dodun O., Nagîț G., Coteață M., Bosoancă G., Beșliu I., <i>„Gheorghe Asachi” Technical University of Iasi</i>	Fine Details Obtained by 3D Printing Using Polymers
<b>Session:</b> Processing and Testing of Polymers and Composites II (Thursday, 3:00 – 3:45, D12) <b>Session chair:</b> <i>Valentina LOPRESTO, University of Naples Federico II</i> <b>Session co-chair:</b> <i>Constantin OPRAN, University Politehnica of Bucharest</i>		
PPE2017-07	Banea M.D., da Silva L.F.M., Carbas R., de Brarros S., <i>University of Porto</i>	Effect of Temperature and Moisture on the Tensile Properties of a TEPs-Modified Adhesive
PPE2017-08	Rosculeț R.T., Stan F., Fetecau C., <i>Dunarea de Jos University of Galati</i>	On the Strain Sensing of EVA/MWCNT Composite
PPE2017-09	Tedde G.M., Santo L., Bellisario D., Iorio L., Quadrini F., <i>University of Rome Tor Vergata</i>	Frozen Stresses in Shape Memory Polymer Composites



## Symposium

### Green Polymers, Reprocessing & Recycling

<b>Session:</b> Green Polymers, Reprocessing & Recycling (Thursday, 4:15 – 5:30, D12)		
<b>Session chair:</b> Mariana BANEA, University of Porto		
<b>Session co-chair:</b> Elena VALCU (HERBEI), Dunarea de Jos University of Galati		
<b>Paper #</b>	<b>Authors</b>	<b>Title</b>
PPE2017-10	Bin Bakri M.K., Jayamani E., Heng S.K., Kakar A. <i>Swinburne University of Technology</i>	Analysis of Acacia Wood Reinforced PLA/PHA Blend Composites
PPE2017-11	Opran C.G., Grosu E., Enachescu M., <i>University Politehnica of Bucharest</i>	Research Regarding the Mechanical Properties of some Biodegradable Polymeric Compositions for Food Packaging Products
PPE2017-12	Sandu L.I., Fetecau C., <i>Dunarea de Jos University of Galati</i>	Mechanical and Rheological Properties of Reprocessed Ethyl Vinyl Acetate (EVA)/Carbon Nanotube Composites
PPE2017-13	Zainescu G., Albu L., Constantinescu R., <i>National R&amp;D Institute for Textile and Leather, Bucharest</i>	Procedure of Obtaining Smart Hydrogels from Leather Waste
PPE2017-14	Sover A., Marzynkevitsch S., Bastian Munack B., <i>Ansbach University of Applied Sciences</i>	Processing Conditions of Expandable Graphite in PP and PA Matrix and their Performance



## Symposium

### Polymer Processing, Rheology & Rheometry

<b>Session:</b> Polymers Rheology and Rheometry (Friday, 10:00 – 10:45, D12)		
<b>Session chair:</b> <i>Mihaela BANU, University of Michigan</i>		
<b>Session co-chair:</b> <i>Felicia STAN, Dunarea de Jos University of Galati</i>		
<b>Paper #</b>	<b>Authors</b>	<b>Title</b>
PPE2017-15	Stanciu N.V., Stan F., Fetecau C., <i>Dunarea de Jos University of Galati</i>	Melt Shear Rheology and PVT Behavior of Polypropylene / Multi-Walled Carbon Nanotube Composites
PPE2017-16	Danu M., Ibanescu A., Ibanescu C., Simionescu B.C., <i>“Petru Poni” Institute of Macromolecular Chemistry</i>	Water and Salt (NaCl) Content Influence on Rheological Behavior of Starch-Gluten Networks
PPE2017-19	Patrascu L., <i>Dunarea de Jos University of Galati</i>	Rheology - a tool to appreciate technological functional properties of different food systems





## Conference venue

Dunarea de Jos University of Galati

Faculty of Engineering, Domnească 111, Galati 800 201, Building D



## Conference sponsors



BANCA TA. ECHIPA TA



GRUPE SOCIETE GENERALE

