The Answers
to Polyolefin Characterization.

4th International Conference on Polyolefin Characterization

The Woodlands welcomes the world experts in Polyolefin Characterization. After the successful editions in Houston, Valencia and Shanghai, the 4th ICPC Conference will be held in Texas, as a leading market today in polyolefin research. Scientists both from the industry and academy from all around the world are expected to attend it. The technical program of 2012 edition will consist of 41 oral and 37 poster presentations, focusing on the latest developments and innovative research in Separation, Fractionation, Molecular Structure and Properties, Morphology and Thermal Analysis, Rheology and Spectroscopy.

www.icpc-conference.org
Dear ICPC Delegate,

Welcome to the 4th edition of the International Conference on Polyolefin Characterization. After successful previous editions in Houston, Valencia and Shanghai, we are proud to host this forth edition again in Texas, as a leading centre in the field of polyolefin research.

Once more, the 4th ICPC Conference will focus on the latest developments and innovative research in the characterization of polyolefins, grouped into sessions on Separation, Morphology, Rheology, Spectroscopy and Mathematical Modeling.

An outstanding technical program, composed of 41 lectures and 38 posters, will shape this 2012 edition, together with vendor presentations, a booth area, a companions program for attendee’s family, and networking cocktails in the evenings that we encourage you to attend.

Additionally, the 4th ICPC Short Course on Polyolefin Characterization Techniques will be held on the first day of the meeting. This one-day training course represents a unique scenario where the world experts in the field share their knowledge and experiences in GPC/SEC, Chemical Composition Distribution, High Temperature HPLC, Cross Fractionation and Preparative Fractionation techniques.

The 4th ICPC will provide once more a platform to bring together researchers from both industry and academia. With attendees from around 20 countries and representing over 50 different organizations that play a key-role in the research or production of polyolefins, ICPC covers again the whole world map, becoming this way a truly unique international conference on the field of polyolefin characterization.

On behalf of the ICPC Technical Committee and Organization, we want to thank most sincerely Speakers, Poster Authors, Attendees and Sponsors and Vendors for your support and active participation.

We hope you enjoy The Woodlands and trust the 4th ICPC will meet your expectations. We would be pleased to see you again at the 5th ICPC in 2014, in Valencia, Spain.

Sincerely yours,

Raquel Úbeda
ICPC Conference Coordinator

On behalf of the 4th ICPC Technical Program Chairs:

Dr. Benjamin Monrabal
Polymer Char
Valencia, Spain

Dr. Colin Li Pi Shan
The Dow Chemical Company
Freeport, TX, U.S.A.

Prof. João Soares
University of Waterloo
Waterloo, Canada

Prof. Minoru Terano
Japan Advanced Institute of Science and Technology

Prof. Dujin Wang
Institute of Chemistry,
Chinese Academy of Sciences
4th ICPC Conference at-a-glance.

Technical Committee
Benjamin Monrabal
Polymer Char, Spain
Colin Li Pi Shan
The Dow Chemical Company, U.S.A.
João Soares
University of Waterloo, Canada
Minoru Terano
Japan Advanced Institute of Science and Technology (JAIST), Japan
Dujin Wang
Institute of Chemistry of the Chinese Academy of Sciences (ICCAS), China

Keynote Speaker
Vincenzo Busico
Federico II University of Naples, Italy

Invited Speakers
Rufina Álamo
Florida A&M University - Florida State University (FAMU/FSU), U.S.A.
Robert Brüll
Fraunhofer Institute for Structural Durability and System Reliability (LBF), Germany
Rongjuan Cong
The Dow Chemical Company, U.S.A.
Paul DesLauriers
Chevron Phillips Chemical Company, U.S.A.
Charles C. Han
Chinese Academy of Sciences, China
Susana Liberman
Universidad Rio Grande Do Sul, UFRGS, Brazil
Faliang Luo
Shenhua Ningxia Coal Industry Group, China
Thomas McLeish
Durham University, United Kingdom
Harald Pasch
University of Stellenbosch, South Africa
Stepan Podzimek
SYNPO / University of Pardubice, Czech Republic
Daniel Read
University of Leeds, United Kingdom
Dalia Yablon
ExxonMobil Research and Engineering, U.S.A.

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DPI, Dutch Polymer Institute

Media Partner
LCGC Group

Facts and Figures
Venue
The Woodlands Waterway Marriott Hotel & Convention Center.
1601 Lake Robbins Drive,
The Woodlands, Houston, TX, U.S.A.

Date
Short Course: October 21, 2012
Conference: October 22 - 24, 2012

Attendees
150

Presentations
Oral: 41
Poster: 38

Countries represented
21
Shenhua Ningxia Coal Industry Group Co., Ltd (Shenning Group in abbreviation) is Shenhua Group’s share-holding subsidiary, and a competitive backbone enterprise of Ningxia Hui Autonomous Region. The group operates in sectors such as coal mining & washing, coal deep processing, coal chemical industry, electric power, real estate and so on. Especially, coal chemical industry has become a pillar industry in group. In accordance with the thought of poly-generation coal-based chemicals circular economy and by introducing advanced technology of coal gasification and synthesis, the coal-based methanol of 0.25 million tons/year, dimethyl ether of 0.21 million tons/year, coal-based methanol 0.6 million tons/year, coal-based olefin 0.52 million tons/year, polypropylene 0.5 million tons/year and polyoxymethylene 0.06 million tons/year have been built and put into production. Coal-based polypropylene and polyoxymethylene have been applied in many fields. By 2015, the capacity of coal indirect liquefaction will achieve 7.4 million/tons, coal-based dimethyl ether 0.83 million/tons, and coal-based olefin 1 million/tons.

Striving to build a world-class modern coal chemical industry featuring industry cluster, technology aggregation, talent gathering and harmonious environment, and of high standard, efficiency and benefits.
Short Course on Polyolefin Characterization Techniques given by the Experts in the field.

SUNDAY, October 21st, 2012

7:30 - 8:20  Registration
8:20 - 8:30  Opening and Introduction to the Short Course

Introduction to Polyolefin Microstructure  João Soares
8:30 - 9:15
- Molecular Weight Distribution.
- Chemical Composition Distribution.
- Bivariate Distribution (Long Chain Branching, Block Co-polymers...).
- Microstructure - Properties.

GPC Basics  Wallace Yau
9:15 - 10:15
- Molecular Weight Average Concept.
- Basic GPC Mechanism.
- GPC Retention.
- Band Broadening.
- Different ways to do Calibrations.
- Basics on IV concept.
- Universal Calibration.
- Basic LS.
- Mark Houwink (MH) Plot.

10:15 - 10:30  Coffee Break

GPC - Practical Considerations  David Gillespie
10:30 - 11:30
- System Considerations:
  - Choosing an Appropriate Column Set.
  - Pump Degradation.
  - Thermal Stability.
  - Data Acquisition.
- Sample Considerations:
  - Solvent and Solvent Preparation.
  - Sample Preparation.
  - Polymer Degradation.
- Calculation Considerations:
  - Flow rate analysis.
  - Mass analysis.
  - Viscosity analysis.
  - M&W analysis.
  - Copolymer analysis.

GPC - Applications in Polyolefins  Wallace Yau
11:30 - 12:15
- Commercial Polymers:
  - HDPE/LDPE/LLDPE/Metallocenes.
  - iPP/iCP/iCP.
- Questions regarding Precision and Accuracy.
- Questions regarding cc-GPC MW, LS-MW, UC-MW.
- LCB analysis:
  - MH Plot with IRS SCB Correction.
  - LS Conformation Plot.
  - LCBI Methodology with Rheology.
- MWD and Rheology:
- Practical Examples and Applications:
  - A case of a Dual Reactor PE.
  - A case of Polymer Blend.
  - Tubular and Autoclave LDPE.
  - Reactive Extrusion.
  - PAO Samples.
  - Polymer Additives.
  - Block Copolymers.
  - EP Composition by IRS and MH Plot.

12:15 - 13:30  Lunch

TREF, CRYSTAF and CEF  Benjamin Montesbal
13:30 - 15:00
- Chemical Composition Distribution importance.
- Analytical Techniques.
- Fundamentals of Crystallization techniques.
- TREF.
- CRYSTAF.
- CEF.
- Molar Mass Dependence.
- Calibration and Calculations.
- Kinetic Effects and Co-crystallization.
- Hyphenated Techniques.
- Applications.
Our customers seek the most innovative products, which is why we focus on breakthrough technology.

ExxonMobil Chemical is a premier petrochemical company and a partner of choice with world-class facilities around the globe. With a relentless focus on state-of-the-art technology and innovative solutions, we are committed to our customers and partners worldwide. We are proud to be a sponsor of the 4th International Conference on Polyolefin Characterization.

exxonmobilchemical.com
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<tr>
<th>Time</th>
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<tbody>
<tr>
<td>15:00 - 15:15</td>
<td>Coffee Break</td>
</tr>
</tbody>
</table>
| 15:15 - 16:15 | **High Temperature HPLC of Polyolefins**  
Willem deGroot  
- Fundamentals of Liquid Chromatography.  
- Classic Liquid Chromatography of Polymers – Examples.  
- Crystallization Elution Fractionation (CEF).  
- Background of HT-LC Development.  
- High Temperature Solvent Gradient Interaction Chromatography.  
- High Temperature Thermal Gradient Interaction Chromatography.  
- Applications and New Developments.  
- References.  |
| 16:15 - 17:00 | **Cross-Fractionation Techniques**  
Alberto Ortin  
- Importance of the Bivariate Distribution.  
- Hyphenated techniques.  
- Preparative Fractionation followed by Analytical techniques.  
- Analytical Cross Fractionation.  
  - TREF x GPC technique description.  
  - Calibration and data processing.  
  - Application examples: blends, copolymers, HDPE, EP.  
  - Additional detectors: IR and LS.  |
| 17:00 - 17:45 | **Preparative Fractionation**  
Benjamin Monrabal  
- Importance of Preparative Fractionation.  
- Solvent–Non solvent (Molecular Weight Fractionation).  
- Dissolution Fractionation (Composition Fractionation TREF).  
- Crystallization Fractionation (Composition Fractionation CRYSTAF).  
- TGIC Fractionation.  
- Characterization of an unknown sample.  |
| 17:45       | Open Discussion                                                        |
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- ENGAGE™ Polyolefin Elastomers
- ENGAGE XLT Polyolefin Elastomers
- ENLIGHT™ Polyolefin Encapsulant Films
- INFUSE™ Olefin Block Copolymers
- OPTICITE™ Label Films
- SEALUTION™ Peel Polymers
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For more information on Dow Performance Plastics, visit www.dowperformanceplastics.com or contact us at 1-800-441-4369 or 1-989-832-1426.
A Technical Program focused on Separation, Morphology, Rheology, Spectroscopy and Modeling.

The 4th ICPC technical program consists of oral and poster presentations in the following polyolefin characterization areas: Separation-Fractionation, Molecular Structure and Properties, Morphology-Thermal Analysis, Rheology, Properties and Spectroscopy.

**SUNDAY - October 21st, 2012**

17:00 - 19:30  Registration
19:30  Welcome Cocktail

**MONDAY - October 22nd, 2012**

7:00 - 8:00  Registration
8:00 - 8:10  Opening Remarks

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>8:10 - 8:50</td>
<td>Spectroscopy - Properties Session Moderator: Minoru Terano</td>
</tr>
</tbody>
</table>
| 8:10 - 8:50 | ¹³C NMR Characterization of Polyolefins: a New Boost in Technology, another Quantum Leap in Data Acquisition and Structure/Properties Understanding.  
*Vincenzo Busico* (Keynote Speaker)  
Federico II University of Naples (Italy) |
*Paul DesLauriers* (Invited Speaker)  
Chevron Phillips Chemical Company (U.S.A.) |
| 9:20 - 9:50 | Study on Microstructure and Property of Coal-Based Propylene and Polypropylene.  
*Faliang Luo* (Invited Speaker)  
Shenhua Ningxia Coal Industry Group (China) |
| 9:50 - 10:15 | Polyolefin Characterization with High Temperature NMR Cryoprobe.  
*Zhe Zhou*  
The Dow Chemical Company (U.S.A.) |
| 10:15 - 10:35 | Coffee Break |

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<thead>
<tr>
<th>Time</th>
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</table>
| 11:05 - 11:30 | A “Systematic Approach” to TD-GPC Data Processing with Band Broadening Correction.  
*Lonnie Hazlitt*  
The Dow Chemical Company (U.S.A.) |
| 11:30 - 11:55 | Evidences of Long-Chain Branching in Ziegler-Natta Polyethylene Homopolymers as studied via SEC-MALS and Rheology.  
*Youlu Yu*  
Chevron Phillips Chemical Company (U.S.A.) |
| 11:55 - 12:20 | Characterization of Long Chain Branched Polymers by Comprehensive Two Dimensional Molecular Topology Fractionation x Size-Exclusion Chromatography.  
*David M. Meunier*  
The Dow Chemical Company (U.S.A.) |
| 12:20 - 13:20 | Lunch |

<table>
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</table>
*Daniel Read* (Invited Speaker)  
University of Leeds (United Kingdom) |
*Ralf Klepinger*  
DSM Resolvo (The Netherlands) |
| 14:15 - 14:40 | Describing Structure Development in Flow Induced Crystallization Using Extended Dilatometry.  
*Martin Van Drongelen*  
Eindhoven University of Technology (The Netherlands) |
| 14:40 - 15:05 | Structure-Property Correlation of Olefin Block Copolymers.  
*Guoming Liu*  
Chinese Academy of Sciences (China) |
<p>| 15:05 - 15:30 | Coffee Break |</p>
<table>
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<tbody>
<tr>
<td>15:30 - 16:00</td>
<td>Polypropylene Heterophasic Copolymer: Molecular Structure Analysis through Fractionation Techniques. <em>Susana Liberman (Invited Speaker)</em> Universidad Rio Grande Do Sul, UFRGS (Brazil)</td>
</tr>
<tr>
<td>16:00 - 16:25</td>
<td>Characterization Comparison between Butene-1/Propylene and Ethylene /Propylene Copolymers. <em>Guo Meifang</em> Sinoppec Beijing Research Institute of Chemical Industry (China)</td>
</tr>
<tr>
<td>16:25 - 16:50</td>
<td>Multidimensional Fractionation Techniques for the Characterisation of HDPE Pipe Grades. <em>Andreas Albrecht</em> Borealis Polyolefine GmbH (Australia)</td>
</tr>
<tr>
<td>16:50 - 17:15</td>
<td>Powerful on-line FTIR Detection in Polyolefin Fractionation. <em>Zengrong Zhang</em> Nova Chemicals Corporation (Canada)</td>
</tr>
<tr>
<td>17:15 - 20:00</td>
<td>Poster Session</td>
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<tr>
<td>18:30</td>
<td>Poster Session Cocktail</td>
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**TUESDAY - October 23rd, 2012**

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<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>8:00 - 8:30</td>
<td>Advances in AFM-based Nanomechanical Measurements of Polyolefin Blends. <em>Dalia Yablonska (Invited Speaker)</em> ExxonMobil Research and Engineering (U.S.A.)</td>
</tr>
<tr>
<td>8:30 - 8:55</td>
<td>Imaging the Molecular Structure of Polyethylene Blends. <em>Chad R. Snyder</em> National Institute of Standards and Technology, NIST (U.S.A.)</td>
</tr>
<tr>
<td>Time</td>
<td>Session</td>
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<tr>
<td>14:15 - 14:40</td>
<td>Investigation on the Molecular Structure- Mechanical Properties Relations in Polypropylene / Poly(Ethylene-Co-Propylene) ((PP/EPR) In- Reactor Alloys.</td>
</tr>
<tr>
<td>14:40 - 15:05</td>
<td>Advanced Analysis of LDPE: Closing the Loop between Chemistry and Product Properties.</td>
</tr>
<tr>
<td>15:05 - 15:30</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>14:15 - 14:40</td>
<td>The Effect of In-Process Ethylene Incorporation on the Evolution of Particle Morphology and Molecular Characteristics of Commercial Heterophasic Ethylene Propylene Copolymers (HEPCs).</td>
</tr>
<tr>
<td>15:30 - 16:00</td>
<td>Molecular Engineering of Process Rheology for Long Chain Branched Melts.</td>
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<td>16:00 - 16:25</td>
<td>A Tool for Deconvoluting the Distribution of Molecular Weight and Chemical Composition of Blends of Ethylene/Octene Copolymers.</td>
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<tr>
<td>16:25 - 16:50</td>
<td>Development of a Mathematical Model for Temperature Rising Elution Fractionation (TREF).</td>
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<td>16:50 - 17:10</td>
<td>Break</td>
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<tr>
<td>17:10 - 18:30</td>
<td>Vendor Session</td>
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<tr>
<td>9:45 - 10:10</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>10:10 - 10:40</td>
<td>Importance of Multi-Angle Light Scattering in Polyolefin Characterization.</td>
</tr>
<tr>
<td>10:40 - 11:05</td>
<td>Application of High Temperature Chromatographic and Viscometric Techniques for the Characterization of Highly Isotactic Polypropylene Samples.</td>
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<tr>
<td>11:05 - 11:30</td>
<td>Characterization of Chemical Composition across Molar Mass Distribution in Polyolefin Copolymers by GPC-IR using a Filter-based IR Detector.</td>
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<tr>
<td>11:30 - 11:55</td>
<td>Preparation of Homogeneous Poly(Ethylene-Co-olefin) and their Use as Standards for TREF, CRYSTAF and Interactive Liquid Chromatography.</td>
</tr>
<tr>
<td>12:20 - 12:30</td>
<td>Adjournment and Goodbye</td>
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<tr>
<td>12:30</td>
<td>Lunch</td>
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**Modeling - Rheology**

**Session Moderator: Paul DesLauriers**

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<th>Time</th>
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<td>Molecular Engineering of Process Rheology for Long Chain Branched Melts.</td>
<td>Thomas McLeish (Invited Speaker)</td>
<td>Durham University (United Kingdom)</td>
</tr>
<tr>
<td>16:00 - 16:25</td>
<td>A Tool for Deconvoluting the Distribution of Molecular Weight and Chemical Composition of Blends of Ethylene/Octene Copolymers.</td>
<td>Ryan J. DePuit</td>
<td>The Dow Chemical Company (U.S.A.)</td>
</tr>
<tr>
<td>16:25 - 16:50</td>
<td>Development of a Mathematical Model for Temperature Rising Elution Fractionation (TREF).</td>
<td>Sirgon Anantawaratskul</td>
<td>Kasetsart University (Thailand)</td>
</tr>
<tr>
<td>16:50 - 17:10</td>
<td>Break</td>
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<td>Vendor Session</td>
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<tr>
<td>18:30</td>
<td>Vendor Session Cocktail</td>
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**WEDNESDAY - October 24th, 2012**

**Morphology (III)**

**Session Moderator: Charles Han**

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<th>Time</th>
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<tbody>
<tr>
<td>8:00 - 8:30</td>
<td>Crystalline Properties of Late Generation Polyolefins.</td>
<td>Rufina Alamo (Invited Speaker)</td>
<td>Florida A&amp;M University - Florida State University (FAMU/FSU) (U.S.A.)</td>
</tr>
<tr>
<td>8:30 - 8:55</td>
<td>Structure Dependent Plasticity of Isotactic Polypropylene.</td>
<td>Dario Cavallo</td>
<td>Eindhoven University of Technology (The Netherlands)</td>
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</table>
The art of connecting

The polymer world is facing a number of challenges and the market demand for polymers is growing. Meanwhile, driven by modern science and technology and pressure from society for new, sustainable solutions, the range and quality of technological options are rapidly increasing. These challenges are too broad and too complex to be addressed by a single party. The Dutch Polymer Institute (DPI) provides a genuine response to those challenges by organising knowledge in the field of polymers and connecting polymer scientists.

DPI connects about 40 knowledge institutes and more than 35 companies. Over 200 inspired researchers from all over the world are engaged in DPI projects. Together we are working on pre-competitive research into polymers and their applications, with a view to stimulating breakthrough innovations and educating researchers.

For more information: www.polymers.nl

Annual Meeting 2012

On 13 and 14 November, DPI will hold its Annual Meeting. This two-day event will take place in Zeist, the Netherlands. The programme includes presentations by national and international speakers from both academia and industry. Confirmed speakers include Professor Sir Richard Friend (University of Cambridge), Professor Ludwig Leibler (ESPCI Paris) and Professor Thijs Michels (TU/Eindhoven).
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<tr>
<td>2. A Comparison between CEF and HT-TGIC of Ziegler-Natta LLDPE resins. Abdulaziz A. Alghyamah1,2, João B.P. Soares1</td>
</tr>
<tr>
<td>3. Mathematical Model of Dynamic Crystallization for Ethylene/1-Octene Copolymers made with Metallocene Catalysts. Nuttawat Chokputtanawuttilerd1, Siripon Anantawaraskul1,2, *, João B. P. Soares1, Abdulaziz A. Alghyamah1</td>
</tr>
<tr>
<td>4. Deconvolution of Molecular Weight Distribution and Chemical Composition Distribution of Ethylene/1-Olefin Copolymers made with Multiple-site-type Catalysts using Genetic Algorithm. Uthana Nanthapoolsub1, Kornwit Saengkhamkhom1,2, Siripon Anantawaraskul1,2 *</td>
</tr>
<tr>
<td>5. Mathematical Model of Gradient Adsorption High Temperature Liquid Chromatography (HT-LC) for Ethylene/1-Octene Copolymers made with Metallocene Catalysts. Nantiya Inwong1, Siripon Anantawaraskul1,2 *</td>
</tr>
<tr>
<td>7. Simulation of Temperature Rising Elution Fractionation (TREF) of Linear Olefin Block Copolymers (OBCs). Ekaphal Srisawangarn1,2, Siripon Anantawaraskul1,2, *, João B. P. Soares1</td>
</tr>
<tr>
<td>8. TREF, CRYSTAF and DSC Calibration using Homogeneous Ethylene/-olefin Copolymers. Olivier Boyron, Christophe Boisson Université de Lyon, France</td>
</tr>
<tr>
<td>10. Chemical Composition Characterization of Ethylene/1-olefin Copolymers using Adsorption Liquid Chromatography and CRYSTAF. Rajesh Chitta1, Robert Bruil1, Christophe Boisson2, Olivier Boyron1, Tibor Macko2</td>
</tr>
<tr>
<td>11. Comparison of Elution Profiles obtained with CRYSTAF, TREF and High-Temperature HPLC for Ethylene/1-Alkene Copolymers. T. Macko1, R. Chitta, R. Bruil1, Ch. Boisson1, O. Boyron1</td>
</tr>
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</table>
12. Evaporative Light Scattering Detector and Calibration of its Response for Polyolefins. 
J.-H. Arndt, T. Macko, V. Busico, R. Brüll
Fraunhofer Institute for Structural Durability and System Reliability (LBF), Germany
Dutch Polymer Institute (DPI), The Netherlands
Federico II University of Naples, Italy

R. Maria, T. Schuster, K. Rode, S. Damodaran, R. Brüll, Mirko Wenzel, Kurt Engelsing, Martin Bastian
Fraunhofer Institute for Structural Durability and System Reliability (LBF), Germany
Suddeutsches Kunststoff-Zentrum (SKZ), Germany

T. Schuster, K. Rode, S. Damodaran, R. Brüll
Fraunhofer Institute for Structural Durability and System Reliability (LBF), Germany

15. Preparation and characterization of PE-g-Alt.
Marco A. da Silva, Griselda B. Galland
Universidade Federal do Rio Grande do Sul, Brazil
BRASIL S.A., Brazil

Camille Descour, Timo Sciarone, Mauritz Kelchtermans, Ilia Korobkov, Robbert Duchateau
Eindhoven University of Technology, The Netherlands
Exxon Mobil Chemical Europe, Belgium
University of Ottawa, Canada

Pilar del Hierro, Jesus Montesinos, Rubén Tarín, Benjamin Monrabal
Polymer Char, Spain

18. Mechanical Properties of Polypropylene/Reduced Graphite Oxide Composites by In-situ Ziegler-Natta Polymerization.
Yingjian Huang, Jin-Yong Dong
Chinese Academy of Sciences, China

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