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The SPE TPO ***Automotive Engineered Polyolefins Conference*** typically draws over 500 attendees from 20 countries on 4 continents who are vitally interested in learning about the latest in rigid and elastomeric TPO as well as TPE and TPV technologies. Fully a third of conference attendees work for a transportation OEM, and roughly 20% work for a tier integrator. Few conferences of any size can provide this type of networking opportunity and offer such an engaged, global audience vitally interested in hearing the latest olefin advances.

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DETROIT TPO AUTOMOTIVE ENGINEERED POLYOLEFINS CONFERENCE®

Welcome to the 2013 SPE TPO Automotive Engineering Polyolefins Conference and Exhibit

Since 1998, the SPE TPO Automotive Engineered Polyolefins Conference has highlighted the importance of rigid and flexible polyolefins throughout the automobile -- in applications ranging from semi-structural composite underbody shields and front-end modules to soft-touch interior skins and bumper fascia. Engineered polyolefins have been the fastest-growing segment of the global plastics industry for more than a decade owing to their excellent cost/performance ratio. The conference typically draws approximately 500 attendees from 20 countries on four continents who are interested in the unique opportunity to network with the major OEM and Tier suppliers and learn more about the latest in rigid and elastomeric TPO as well as TPE and TPV technologies. Fully a third of conference attendees say they work for a transportation OEM, and roughly 20% work for a tier integrator/molder, with the balance from materials or reinforcement suppliers, equipment OEMs, industry consultants, and members of academia.

The Society of Plastic Engineers (Detroit Section), leading OEMs, Tier, resin and equipment suppliers have dedicated their resources to create this, the 15th Annual SPE Automotive TPO Global Conference. The conference is a dynamic, interactive, and cost-effective learning experience "put together" and "contributed to" by the world's foremost authorities on materials, processes, applications, and market trends.

The mission of SPE International is to promote scientific and engineering knowledge relating to plastics worldwide and to educate industry, academia, and the public about these advances. SPE's Detroit Section is active in educating, promoting, recognizing, and communicating technical accomplishments for all phases of plastics and plastic-based composite developments - particularly in the automotive industry.

This year's program features 8 technical sessions with over 70 presentations. A wide range of industry topics will be covered including: Advances in Automotive Polyolefins, Rigid Polyolefin Compounds, Automotive TPEs, Automotive Interior Trim and Skins, Surface Enhancements, Molding and Forming TPOs, Lightweighting of Polyolefin Parts and Adhesives and Coatings for TPOs.

Additionally there are five keynote speakers:
Jeff Schuster - LMC Automotive - Global Automotive Outlook, What is in Store Beyond Uncertainty?
Klaus Busse - Chrysler Group LLC - Plastics Key Role in Design & Manufacturing
Dr. Rose Ryntz - IAC - Olefinic Materials Opportunities in Interior Applications
Seiji Oshima - Advanced Composites Inc. - Global Challenges: Supporting OEM PP & TPO Strategies
Thomas Wagner - Borealis AG - Innovations in TPOs for the Automotive Industry

Thank you for attending this year's conference. We invite all attendees to visit our exhibitors and enjoy one on one dialogue with the presenters, exhibitors and your industry colleagues. We appreciate your comments and feedback as we continue to strive to meet your needs.

Bill Windscheif
Co-Chairman
Advanced Innovative Solutions, Ltd.

Jeff Valentage
Co-Chairman
ExxonMobil Chemical Company

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Ron Price *Global Polymer Solutions*
Sanjay Patel *Flint Hills Resources*

15TH-ANNUAL SPE DETROIT TPO AUTOMOTIVE ENGINEERED POLYOLEFINS CONFERENCE

KEYNOTE SPEAKERS

Jeff Schuster

Senior Vice President
Forecasting
LMC Automotive

Global Automotive Outlook -- What is in Store Beyond Uncertainty?

BIOGRAPHY

In his current position, Schuster is one of the firm's primary global automotive experts providing oversight of the global light vehicle sales and production forecasts and process at LMC, while also being responsible for all activities in the Americas region and serving on LMC Automotive's board of directors. He has been tracking developments in the global automotive industry for nearly 20 years and has been with LMC Automotive since its inception in 2011. He is widely quoted by automotive press in print, broadcast, and internet reports and frequently makes conference and seminar presentations on topics like current assessments and outlook for the auto industry. Before joining LMC Automotive, Schuster led the automotive forecast division of J.D. Power and Associates and has experience in financial analysis and cash management in the automotive supply base. He holds a Bachelor's degree in Finance and an M.S. degree in Corporate Finance from Walsh College. He is an active member of Society of Automotive Analysts and the Automotive Press Association.

Klaus Busse

Head of Interior Design
Chrysler Group LLC

Chrysler Group's Journey to World Class Interiors

BIOGRAPHY

In his current position, which he has held since 2009, Busse is responsible for the interior design of Chrysler, Jeep®, Dodge, Ram Truck, and SRT brand vehicles and elevating the company's interior designs to world-class levels. He has overseen the designs of award-winning interiors, including the 2011 Jeep Grand Cherokee, 2013 Dodge Dart, and 2014 Ram Truck. Busse joined Chrysler in 2005 after 10 years at Mercedes-Benz Design in Germany. He first discovered his passion for sketching cars during high school math class. Before locking into automotive design, Busse explored fine arts and industrial design. An internship within the Mercedes-Benz Design Office confirmed his career choice in automotive design. Born in Minden, Germany, Busse holds a B.A. degree in Transportation Design from Coventry University in the U.K.

KEYNOTE SPEAKERS

Dr. Rose Ryntz

Senior Director
Advanced Engineering/
Material Development
International Automotive
Components Group (IAC)

Olefinic Material Opportunities in Interior Automotive Applications

BIOGRAPHY

Ryntz holds a Ph.D. in Polymer / Organic Chemistry and an MBA. During her career she has worked at Dow Chemical, DuPont Automotive, Ford Motor Co., Akzo Nobel N.V., and Visteon Corp. before assuming her current role at IAC Group North America. She is a prolific invited speaker, has published extensively (with over 100 publications, 25 patents, and four books), and is a recipient of many prestigious awards, including International Biographical Center Who's Who in the World, Best Paper and Best Speaker awards through the Federation of Societies for Coatings Technology (FSCT) as well as SPE, the FSCT Women in Coatings Management Achievement Award, George B. Heckel Award & Matiello Award, the American Chemical Society (ACS) Roy Tess Award, the Women Automotive Association International Professional Achievement Award, the Outstanding Leadership Award sponsored by the Engineering Society of Detroit (ESD), the Elias Singer Best Paper Award sponsored by the University of Southern Mississippi, the Gold Award sponsored by the ESD, a Roon Award sponsored by the FSCT, and the Henry Ford Technology award presented by the Ford Motor Co. for outstanding technical contributions to the company. She also has served as president of FSCT, is a fellow in SPE, serves on the board of directors of the Detroit Section of SPE, and is one of the founding members of the SPE TPO Automotive Engineered Polyolefins conference.

Seiji Oshima

President and CEO
Advanced Composites, Inc.

Global Challenges: Supporting OEM PP and TPO Strategies

BIOGRAPHY

Oshima has held his current position at Advanced Composites, an operating unit of Mitsui Chemicals, Inc., Tokyo, Japan, since 2012. Prior to this, he was general manager-Performance Compounds Division of Mitsui Chemicals, Inc. between 2010 and 2012, and before that he was deputy general manager-Nonwovens Division at the company from 2008-2010, and between 2006 and

2008 he was deputy general manager-Electronics & Information Division. Before 2006, Oshima held a variety of commercial positions at the company, including an 8-year rotation in the U.S. He holds a degree in Economics from Keio University in Tokyo

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KEYNOTE SPEAKERS

Thomas Wagner
Global OEM Manager
Borealis AG

Innovations in TPOs for the Automotive Industry

BIOGRAPHY

Wagner has held his current position at Borealis since 2007. From 2005-2007, he was senior consultant and office manager at PLEON Publico Public Relations & Lobbying, and from 2000-2005 he was a market development engineer at Borealis. Between 1996 and 2000, he was deputy manager-Quality Assurance for tier 1 Zizala GmbH Lichtsysteme and he was manager-Quality Assurance at Fa. Ankerbrot during the latter part of 1996. Before that he was deputy production manager at General Biscuits Österreich from 1991-1996, and from 1989-1991 he worked in the R&D lab at Fa. Ybbstaler Obstverwertung. Wagner holds a Global Executive MBA from Emory University, a Master's in Key Account Management from the Management Development Institute (MDI, Vienna, Austria), as well as a degree from the Technical College of Chemical Industrial Engineering in Wels. He also has done course work at the Academy for Marketing and Management and the Commercial Excellence Program at the International Institute for Management Development (IMD, Lausanne, Switzerland).

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ADVANCES IN AUTOMOTIVE POLYOLEFINS

SESSION CO-CHAIRS

Neil Fuenmayor
LyondellBasell

Dr. Debra Mielewski
Ford Motor Co.

Greener Polypropylene Compounds for Automotive Interiors

Karen Stoeffler
National Research Council of Canada

In this presentation, NRC will introduce greener plastics and composites having the potential to compete with petroleum-based PP compounds conventionally used for automotive interiors. PP / PLA and PP / PBS blends integrating up to 30 wt.% bio-based resin and retaining good mechanical and thermal properties were developed. NRC will show how those blends can be further compounded with bio-reinforcements to tailor cost, density, properties, and to further increase renewable content.

Using Cellulose Fibers for Reinforcement in Polyolefins

Dr. Bob Hamilton
Weyerhaeuser

Weyerhaeuser has introduced THRIVE, a product line of cellulose fiber reinforced thermoplastics. We will present data on the performance of reinforced polypropylene, discussing the product properties and advantages relative to traditional reinforced polypropylene. Cellulose fibers allow users to, among other things, greatly shorten injection molding cycle times while retaining the beneficial aspects of fiber reinforcement.

Biofiller Application in Automotive Thermoplastic Olefin Compounds

Charlie Yang
LyondellBasell

There is renewed interest in the use of natural fibers as the reinforcing fillers in polymers. Fibers from renewable sources have advantages such as low densities, high specific properties, and environmental friendliness. However, they also present challenges in processing and meeting application requirements due to hydrophilicity and low temperature resistance. This presentation reviews biofillers categories and offers a summary status of biofiller reinforced automotive polyolefin compounds. Biofillers were benchmarked against traditional reinforcing fillers typically used.

Polyolefin Elastomers Contributing to TPO Growth and Evolution

Jim Hemphill
The Dow Chemical Company

Fuel and emission regulations are placing increased emphasis on the use of plastics to replace heavier materials. Plastics including thermoplastic polyolefins (TPOs) have significantly grown to replace metal for a variety of applications including bumper fascia, exterior trim, and interior panels. This paper will explore the evolution of TPOs and how polyolefin elastomers are a key enabling TPO compound ingredient.

ADVANCES IN AUTOMOTIVE POLYOLEFINS

A Smart Approach to High Reinforcement Talc-based TPOs

Piergiovanni Ercoli Malacari
IMIFabi SPA - Italy

In plastic applications, the automotive industry demands high performance combined with visible weight reduction. In TPO modification, when even superior rigidity is requested, standard fine or ultrafine talc grades could record some limitations. In order to fill this gap, IMIFabi has developed a new product, intended to achieve higher rigidity: NTT05. In this paper, several performance behaviours will be demonstrated in order to highlight the set of properties achievable by using NTT05 in comparison with other standard talc grades.

Next Generation Low CLTE TPO Materials to Replace Metals and Engineering Plastics for Higher Performance Applications

Sunit Shah
LyondellBasell

Largely due to fuel efficiency requirements, automobile weight reduction has become a priority. In applications such as fascia and exterior trim, incremental weight targets have been achieved by replacing higher density metals with lower density metals and/or plastics. However, for some applications, such as lift gates, body panels and grilles, the CLTE of TPOs is too high. Next generation TPO materials have been designed to match the low CLTE requirements, while providing other performance advantages.

Surface Aesthetics: Delivering Innovative Solutions for Painted and Unpainted Automotive Exterior PP Applications

Jakub Oliverius
Borealis Polyolefine GmbH, Austria

Long-glass Primerless paintable compounds capable of tough steam jet test conditions, mould-in-color solutions for special effect parts and tigerstripe-free materials applicable under broad processing windows--these are the results of Borealis research, driven by the needs of leading OEMs and Tiers, offering system cost reduction potential and sustainable appeal, while providing outstanding visual appearance for automotive exterior polypropylene applications.

Tailor-made PP Compound Solutions to Meet Global OEM Requirements

Christelle Grein
SABIC

Demanding Global OEM requirements call for tailor-made dedicated PP compound solutions. Beyond traditional material requirements, combinations of antagonistic features like good paintability at low weight, low organoleptics with excellent scratch resistance, or defect free surfaces at low shrinkage have become key qualifiers to enter and grow in a market driven by high technical and quality standards. This paper will present SABIC's latest developments, showing how complex performance profiles are addressed in an innovative way to satisfy customers.

RIGID POLYOLEFIN COMPOUNDS

SESSION CO-CHAIRS

Mike Balow
Asahi Kasei Plastics North America Inc.

Ermanno Ruccolo
Mitsui Plastic, Inc.

Vehicle Interior Air Quality

Mark Polster
Ford Motor Company

The exposure to Volatile Organic Compounds (VOCs) has attracted attention in recent years.Vehicle Interior Air Quality (VIAQ) is a measure of the concentration of these chemical compounds in the vehicle's interior air. Lowering VOC interior emissions are due to regulatory actions starting in 2007 and regulations exist in Japan, China and Korea.

To comply with standards the automotive industry conducts component or material VOC testing. Correlation studies attempt to set material level requirements suppliers must meet to insure vehicles comply with global requirements. Standard component and material methods are being developed by several industry work groups. Industry standardization is critical to shrinking the test burden, reducing the cost of low VOC parts, leveling the playing field and improving the driving experience.

Attempt of an Instrumental Analytical Description of the PP Aging Status

Dr. H.P. Schlegelmilch
IMAT-UVE GmbH, Mönchengladbach

Since the onset of lightweight construction in the automobile industry, material requirements, utilization areas, and design requirements regarding plastics have continuously changed. Meanwhile, approx. 20 % of the entire vehicle weight consists of plastic materials (as at 2012). In 1950, it was only 2 %. One of the most important plastic materials is PP, at up to 100 kg per vehicle, due to its broad application range, its low weight and low productions costs.

In the present tests, PP was exposed to artificial and natural weathering to collect key material data. In order to estimate the life span of plastic materials in outdoor and indoor areas, the polymer properties have to be identi fied, as well as their modifications if the irradiated dose is increased, and whether there is a regularity during the irradiation period respectively.

This is supposed to enable prediction of the aging behaviour based on simple processes and general load/effect scenarios. Relevant measurement properties will be discussed. Furthermore, a special surface-sensitive procedure enables us to make statements on the course of the chemical degradation processes.

State of the Frontier with Some Focus on TPO Materials

Michael Wolkowicz
MDW Solutions, LLC

A snapshot of the polymer nanocomposite industry as it stands today almost 30 years after commercialization is presented. Emphasis on TPO materials and general growth patterns in this area will also be discussed. Focus will be placed on how the relatively young nanocomposite industry has changed since its beginnings in the 1980's with the introduction of nanoclay composites by Toyota and where the frontier is today.

This will take into account where research and development is being done, what the current areas of focus for development are, the development and discovery of new nano-fillers which drive new composites, how products are being commercialized, and where they are used.

Novel Polyolefin Compounds with Optimal Balance of Scratch Resistance, Stress Whitening Resistance and Impact

Vaibhav (Vive) Apte
Asahi Kasei Plastics North America, Inc.

Polypropylene based TPO compounds have been used for several decades in automotive applications that require acceptable modulus coupled with good scratch resistance and ductile failure mode for multiaxial impact. However, some of these TPO compounds have some limitations in terms of stress whitening resistance.

Asahi Kasei Plastics has recently developed a portfolio of anti-stress whitening PP compounds. These can overcome some of the shortcomings of conventional PP based TPO grades in the areas of stress whitening resistance while still

RIGID POLYOLEFIN COMPOUNDS

providing acceptable impact performance.

Test data is presented for these novel anti-stress whitening PP compounds compared to conventional PP based TPO grades for standard mechanical properties as well as scratch, multiaxial impact and stress whitening resistance.

Advanced Nucleating Agent for Light Weighting of PP and TPO Parts for Automotive Applications

Takahiro Horikoshi
ADEKA Corporation, Japan

The use of polypropylene based parts in automotive applications continues to grow. Recent initiatives to improve fuel economy have prompted manufacturers to reduce the weight of their parts. One solution is to develop PP with enhanced properties which will allow manufacturers to down gauge without sacrificing properties.

An appropriate use of polymer additives, especially, nucleating agents is one of the most cost-effective solutions to meet these requirements. Several nucleating agents are commercially available, for example, organophosphorous salt and carboxylic acid salt. This paper describes an advanced nucleating agent that imparts improved mechanical properties such as higher flexural modulus and heat distortion temperature, allowing weight reduction of PP and TPO composites for automotive parts.

Performance of Mica Reinforced PP in Scratch Resistant Applications

Jim Harper
Imerys Performance Minerals

Polypropylene compounds with mineral reinforcements such as mica, talc are used in a wide range of automotive applications. The challenges of managing scratch resistance when formulating compounds utilizing higher loading levels of reinforcing minerals is always of concern in appearance applications for automotive interior, exterior and under the hood.

Mineral reinforcement selection is based on the desired physical, thermal and impact properties such as tensile strength, stiffness, thermal resistance and impact strength and dimensional stability.

The current research examines the scratch behavior of mica reinforced polypropylene homopolymer compounds as well as their key physical properties as well as examining the effects of common migratory and non-migratory scratch resistance additives.

Innovative Glass-filled Polypropylene Technology for Enhanced Performance in Structural Applications

Katie Shipley
Asahi Kasei Plastics North America, Inc.

Long-glass polypropylene products have been in use for various automotive components that require a good balance of structural strength and excellent impact performance as compared to short glass-fiber based variants. Advancements in glass-filled polypropylene technology have enabled replacement of high-performance costly engineered compounds to derive weight and value advantages.

Continuing the trend, Thermylene I is the latest innovation from Asahi Kasei Plastics North America, Inc. with a portfolio of customized polypropylene compounds as viable alternative to conventional long-glass polypropylene and polyamide-based incumbents. Thermylene I compounds deliver differentiated performance characteristics beyond those offered by conventional long-glass based compounds today. Relevant innovation characteristics and supporting test data will be presented.

AUTOMOTIVE TPEs

SESSION CO-CHAIRS

Robert Eller
Robert Eller Assoc. LLC
Jeff Valentage
ExxonMobile Chemical Company

PLENARY TALK: TPEs Meeting Automotive Challenges

Robert Eller
Robert Eller Assoc. LLC

The performance requirements for automotive materials are rapidly changing with severe pressures for improved fuel economy, globalization, shifts in fleet composition, connectivity, high volume global platforms and the evolution of global sourcing requirements. This paper will examine technical developments in the materials side of the TPE families (polymer structure, compound formulation, physical form, films, foams, shapes) and the processing of TPEs to meet evolving automotive challenges such as high temperature performance, the role of TPEs in connectivity, sensing, renewability, display, improving luxury feel, and more efficient component fabrication and assembly, sealing, fabric coating.

TPV Beyond EPDM/PP Improved Thermal Performance and Enhanced Oil and Chemical Resistance

Dr. Allen Donn
Kraiburg TPE Corporation

KRAIBURG TPE has significantly expanded its portfolio of thermoplastic elastomers with the addition of innovative products specifically designed for applications where improved oil and chemical resistance is critical to end-use durability. These TPV technologies, in addition to providing enhanced oil and chemical resistance, also afford significantly improved long term temperature performance, UV resistance, adhesion to Engineering Thermoplastics (ETP) and, in the case of HIPEX®, high temperature resistance. Recognizing also the potential value that these performance improvements can provide in overmolding design features, KRAIBURG TPE has developed grades specifically for bonding to a range of ETP substrates including ABS, PC and specialty nylons. Additional benefits associated with enhanced resistance to engine and gearbox oils will also be highlighted.

Polymer Neutral Approaches to Fit Developing Automotive Requirements

Jeff Dickerhoof
Teknor Apex USA

Global automotive requirements are driving the necessity for diversification of thermoplastic elastomer type materials specified in critical application areas. Particularly for sealing systems, advances in material technology have opened opportunities for TPV alternatives like TPO and TPE-S. This presentation will highlight automotive applications which have been able to utilize TPV alternatives successfully and how a polymer-neutral approach was taken for their development

SEPTON K Series: New Bondable Styrenic Thermoplastic Elastomers

Asako Minamide
Kuraray America Inc., SEPTON Business Unit

Kuraray Co., Ltd. manufactures styrenic thermoplastic elastomers, under the trademarks of SEPTON and HYBRAR. These elastomers cover a wide range of applications including thermoplastic compounds, polymer modification, adhesives, flexible PVC substitutes and vibration damping. SEPTON K series is a new elastic material which features superior adhesion to metal, glass and various types of resins including polyolefins. The superior bond ability is obtained via heating without

the presence of any primer or pretreatment. This material has plasticity, elasticity and mechanical properties similar to existing thermoplastic elastomers. SEPTON K series will be applicable to various applications using these unique features.

Total TPE–based Dashboard and Interior Soft Trims

Mark Rodden
So.F.Ter U.S.

The automotive industry is constantly looking for ways to produce vehicles that are more sustainable. For plastic materials, the research goes mainly in two directions: 1) reducing vehicle weight of vehicles and 2) increasing recycling opportunities throughout vehicle production and life-cycle. So.F.Ter presents a solution that allows the achievement of remarkable results on both sides.

A new thermoplastics system for the production of dashboard and interior soft trim has been developed: consisting of three layers: a rigid layer made of reinforced polypropylene with high dimensional stability, an intermediate junction layer made of polyurethane foam and a soft skin upper layer made of TPE with slush molding technology. The tri-material panel obtained with this method is 100% recyclable at the end-of-life of the vehicle and via grinding it is possible to obtain a new, reusable engineering plastic.

Abrasion Resistant Thermoplastic Polyester Elastomers

Mukul Kaushik
Celanese Corp., Ticona Engineering Polymers

New abrasion resistance thermoplastic polyester elastomers (COPE) have been developed to deliver excellent performance over a wide range of speed and load conditions in sliding or moving applications. These thermoplastic elastomers have excellent cold temperature impact strength and work well at a broad range of temperature and humidity conditions, primarily in injection molded articles.

Various grades with a wide range of hardness are suitable for several applications requiring excellent tribological properties. These elastomers provide outstanding ductility combined with the excellent chemical and environmental resistance properties of polyesters.The unreinforced and higher flexibility COPE grades fill the property gap between standard thermoplastic polyesters, urethanes and vulcanized rubbers by providing excellent fatigue strength and hence longer lifetime. These plastics are easy to process, recyclable and retain their impact strength down to -30 °C.

TPO Green Materials for the Automotive Application: Model of Sustainable, Renewable, and Recyclable Materials

Farzana Hussain
Mytex Polymers

Most fibrous composite materials currently used in aerospace, marine, and auto industries consist of high strength fibers such as Carbon or Glass Fiber (GF) in a polymeric matrix. However, glass and carbon fibers are non-recyclable, non-biodegradable, made from non renewable sources, and may cause skin irritation and health risks to the humans. Plant-based natural fibers such as cellulose fiber, hemp, flax and jute have generated renewed interest in the automotive and the plastic industries in the last few years because of their potential to develop environmentally friendly composites with lower density and less energy than the GF. The goal of this work is to reduce the dependency on non-biodegradable polymer and conventional GF with the use of renewable and recyclable resources.

AUTOMOTIVE INTERIOR TRIM & SKINS

SESSION CO-CHAIRS

David Helmer
General Motors

Yvonne Bankowski
Ford Motor Company

PLENARY TALK: Meeting the Needs of the Future with In-House Materials and Manufacturing

Ken Gassman
Inteva Products, LLC

An overview of the evolution of vehicle interiors along with trends in material and processes technologies will be discussed. The presentation also highlights market drivers, material and process advancements for the interiors of the future. A case study of GM's Award winning 2013 Crossover vehicle introductions will also be included.

Interior Material and Process Technologies that Meet Styling Demands AND Reduce Mass

Dr. John O'Gara
Inteva Products, LLC

Inteva has successfully launched full instrument panel programs that utilize cross-linked PP foamed backed bilaminate TPO sheet in Press Bonding and Press Lamination processes, which can yield significant weight and space savings over conventional foam in place polyurethane constructions. In addition, these constructions yield products with similar haptics to more expensive options. The influence of various Inteva materials and processes on the interior part construction as related to weight, cost, space, and surface appearance will be compared.

Study of Extrude-to-Color for Automotive Interior Skins

Dr. Sam He
Inteva Products, LLC

The extrude-to-color TPO roll goods can provide advantages, such as luxurious appearance and good haptic feeling; excellent resistance to abrasion, heat, weathering, and chemicals; and fl exibility for various forming processes. This color study covers all major components and processing steps for extrude-to-color TPO roll goods for automotive interior applications. The study identifies the sources and levels of color variations for extrude-to-color TPO roll goods. The results show that color variation initially from the colorant is carried to downstream production. With advanced color quality control in place, the extrusion (extrude-in-color) and painting processes are capable in producing roll goods with high quality in color.

Innovation in TPO Foil for Automotive Interiors

Linda Sun
Canadian General Tower Ltd

A new trend for automotive door lowers is to apply a thin layer of TPO foil into the injection molding process to achieve the superior appearance with matched color, and improved scuff and mar resistance, as well as the enhanced haptic feels. Recently CGT has developed a thin, soft TPO foil with great heat resistance and excellent grain reflection for injection molding application, also provided enhanced scuffing and marring resistant and soft haptic feel.

Green TPO Materials for Airbag Cover Applications

Ryosuke Kurokawa
Sumitomo Chemical Co. Ltd.

From the environmental viewpoint, two types of new eco-friendly thermoplastic elastomers (TPE) for airbag cover applications were developed. The first compound is a TPO which gives the airbag cover an excellent appearance at a lower cost which does not require the painting step for the aesthetic control in airbag cover manufacturing. The second compound is olefinic TPE containing biomaterial-based plastics. By applying optimized compatibilizer and our unique blending technique, we succeeded in obtaining the Biomass-TPE which showed almost the same physical properties as current commercial TPE.

SURFACE ENHANCEMENTS

SESSION CO-CHAIRS

Dr. Rose Ryntz
IAC

Jim Keller
United Paint

Advancements in UV and Thermal Stabilization for Automotive TPO

Fadi Khawam
Cytec Industries Inc.

Vehicle development in the past 20 years can be characterized by comfort improvements, design breakthroughs, improved performance efficiencies, advanced materials development and new safety systems. Advancement of plastics has been highlighted for a concept car, which is eco-friendly and lighter, leading to higher fuel efficiency. To further enable the use of TPO, stringent UV and thermal standards need to meet automotive standards. This paper will discuss the development of automotive TPO, the UV and thermal automotive standards and also development of a new stabilizer system meeting both UV and thermal.

Advances in Colorability and Weathering Resistance of COPE

Bruce Mulholland
Celanese Corp., Ticona Engineering Polymers

Copolyester elastomers (COPE) are high performance thermoplastic elastomers. The sensitivity of COPE to photo-oxidation restricts their broad use in applications requiring UV stability. These would include injection molded applications such as interior automotive trim or monofilament for automotive seating fabric. Conventional copolyester elastomers become brittle upon UV exposure. For example, some commercial monofilament can lose 95% of its initial ductility after only 500 kJ/m2 exposure to SAE J1960 exterior Xenon test method. Advances in stabilization have allowed monofilament to be produced to maintain 100% of its ductility even after 2,000 kJ/m2 exposure. This paper will review the advances in UV stabilization of COPE and potential uses for this new material.

Ageing of Surface Treated TPOs

Russell Brynolf
FTS Technologies

This paper will explore and discuss the ageing process and effects on TPO panels over a 12 month period. We will present data from three methods of surface treatment, showing changes to elemental composition, surface energy and adhesion strength respectively. We will present conclusions and discuss the feasibility and dependence of users on surface energy test methods and the resultant expectations of adhesion strength.

Openair® Plasma Treatment of TPO and Plastic Materials for Improved Adhesion Performance

Shaun Glogauer
Plasmatreat North America

This presentation will consist of a brief introduction to plasma and plasma technology. Plasma is basically excited air molecules that work to clean and activate a surface for bonding and coating applications. This process can often lead to the elimination of aggressive primers, adhesion promoters, and solvent wiping applications. Practical applications within the automotive industry as well as a few very short videos to illustrate the technology will be discussed.

Advances in Waterborne Halogen-free Adhesion Promoters for Difficult Substrates

Keith Moody
Eastman Chemical

Novel waterborne nonchlorinated adhesion promoters have been developed for green coatings

SURFACE ENHANCEMENTS

for thermoplastic polyolefin (TPO) plastics. These aqueous systems containing functionalized polyolefins and environmentally friendly APEO free surfactants can be formulated into both interior and exterior automotive coatings. The nonhalogenated systems can be formulated into primers or stir-in additives in waterbased formulations. This paper will present information on how to formulate these adhesion promoters and the results of adhesion testing on new plastic substrates.

Metamerism in Plastics

Steve Goldstein, Ph.D.
Clariant Corp.

Metamerism is the matching of apparent color of objects with different spectral power distributions. Colors that match this way are called metamers. The paper will show how differences in resin cause metamerism and what one sees when thinking they are using similar colorants yet the final products are metameric.

The Latest Developments In Scratch and Mar Resistance for Interior Surfaces

Bhushan Deshpande
Techmer PM, LLC

Automakers have sought solutions including scratch and mar solutions to provide beauty to plastic surfaces. This presentation explores methods for imparting this resistance on interior plastic surfaces. Scratch testing is done on test plaques at various levels of force. The plaques are also subjected to exposure in the weatherometer and measured for color and gloss integrity. Achieving superiority in one performance criteria can negatively impact others, making the challenge a technical balancing act.

Improving Scratch Resistance of Polypropylene Without Side Effects

Kumar Kunal Ph.D., Kathrin Lehmann
Evonik

Organomodified siloxanes are a special class of polymers with functional groups tailored for specific properties attached to the siloxane backbone. Unlike ordinary siloxanes, these molecules anchor to the polymer bulk and provide special properties without migration to the surface, such as scratch resistance, melt flow improvements and flame retardance. They can be incorporated into the compound, and eliminate the need for coatings. The presented work focuses on the parameters that influence the scratch resistance of automotive interiors based on polyolefin compounds, such as graining, talc particle size, master batch content, and thermoplastic olefin type.

Addressing Stress Whitening in Polypropylene Copolymers

Chris Miller
Americhem

Americhem's presentation will focus on stress whitening in polypropylene copolymers. Stress whitening will be defined and different testing methods will be examined. We will touch upon polypropylene differences and discuss different factors that could contribute to stress whitening, such as resin selection, design and tooling considerations, pigment load, and processing. Finally, some strategies to work through stress whitening problems will be discussed.

SURFACE ENHANCEMENTS

SESSION CO-CHAIRS

Dr. Rose Ryntz
IAC

Jim Keller
United Paint

High Performance Interior TPO with Mold Temperature Independent Scratch Resistance

Jason Fincher
Advanced Composites Inc.

Typical mold-in-color TPO materials require elevated mold temperatures to provide acceptable scratch resistance. However, Advanced Composites has developed a scratch resistance technology that is independent of mold temperature. This yields increased processing flexibility without compromising quality. Excellent weatherability has also been demonstrated in accelerated Xenon and outdoor testing. Advanced Composites' novel scratch technology achieves the scratch resistance and weatherability necessary for high performance interior applications.

Siloxane Masterbatch Additives for Scratch Resistance Improvement of Filled Automotive PP Compounds

J. Habimana, Ted Hays
Multibase: A Dow CorningCompany

Various additives, and combination of additives, have been used over the years to improve scratch and mar resistance of filled PP compounds.

Siloxane based additives have become one of the top choices due to their inherent molecular stability and high performance attributes.

Multibase, a Dow Corning Company, has pioneered many thermoplastic siloxane masterbatches based on ultra high molecular weight polydimethylsiloxane polymers reactively dispersed with carrier resins. This paper specifically addresses the scratch resistance performance improvements that are achieved with Dow Corning® Siloxane Masterbatch, added to filled PP compounds.

Scratch Resistant Waterborne Coating for Interior TPO

Jim Keller
United Paint

Coatings are often used for automotive interior plastic parts to hide surface inconsistencies, provide color and gloss control, uv protection and, in some cases, create metallic effects or impart a tactile feel.

TPO has historically been a challenging substrate for wetting and adhesion of coatings, but these problems have been overcome through the use of newer pretreatment or primer technologies and through adhesion promoter additives for direct-to-TPO coatings. This presentation will focus on new waterborne coating technology that can be applied to TPO to create surfaces with very low gloss and excellent scratch resistance.

MOLDING & FORMING TPOs

SESSION CO-CHAIRS

Hoa Pham
Avery Dennison

David Okonski
General Motors

Weight Saving Opportunity with a Foamed High Melt Strength PP

Elke Pachner
Borealis Compounds Inc.

Low density foams based on long chain branched polypropylene make a significant contribution towards material savings and therefore weight reduction compared to high density foams or other non-foamed application alternatives. Daploy HMS PP materials are non-cross linked, allowing them to be re-molten and recycled. As a mono-material solution, Daploy HMS PP provides straight-forward recycling compared to multi-material or cross linked solutions. The wide mechanical property range combined with the good chemical and high thermal resistance allows the use in applications such as automotive applications.

Optimizing Sheet Extrusion Conditions to Minimize Internal Stresses in Thermoformed Sheet

Tim Womer
TW Womer and Assoc. LLC

As flexible polyvinyl chloride (FPVC) is processed and cooled in a typical plastic sheetline system, complex patterns of internal stresses are developed as the result of restraints characteristic of normal shrinkage. The ability to control or minimize these stresses makes it possible to determine the characteristics of processes performed on the sheet afterwards. Alloyed FPVC sheet was extruded under controlled conditions. Critical conditions include: draw ratio, die temperature, melt temperature before the die, center chill roll temperature, and bottom roll temperature on a three roll down-stack sheetline.

Twin Screw Extrusion: Fundamentals, Techniques and Options for Compounding TPO

Paul Andersen
Coperion Corporation

The co-rotating twin-screw compounder has long been the equipment of choice for compounding functions. However, compounders still face processing challenges such as how to incorporate a high loading of low bulk density mineral filler and maintain an economically viable production rate, how to maximize fiber length in high viscosity high mineral filled formulations, how to efficiently incorporate high levels of liquid, how to eliminate (or at least minimize) the possibility of contaminants in the finished product, and how to enhance productivity. This paper gives an overview of the co-rotating twin screw compounding technology, and discusses the unit operations within the compounding process. Examples of some compounding systems are presented.

MOLDING & FORMING TPOs

SESSION CO-CHAIRS

Hoa Pham
Avery Dennison
David Okonski
General Motors

Processing Tips for Molding Polypropylene and TPOs

Dave Harper
ExxonMobil Chemical Company

For over 25 years, polypropylene and TPO materials have been utilized to produce interior, exterior, and under the hood automotive components. With enhancements in materials, machines and injection mold tooling, it is essential for material suppliers to provide continuing education to the industry on the latest processing guidelines. Following the material supplier's process recommendations will help product performance meet requirements, maximize the use of capital assets and improve part quality. This presentation will focus on critical material process parameters that need to be controlled.

Numerical Visualization on Thermal Mechanism of Conformal Cooling Efficiency in the Injection Molding Process

S.W. Huang et al, K. Cheng
Moldex 3D, National Tsing-Hua University

In the injection molding process, a well designed cooling system can effectively shorten cycle time, enhance product quality and save fabrication cost. In the traditional molding method, the cooling system layout is restricted. With newer methods, conformal cooling channels are more suitable to the cavity geometry. This paper presents molding simulation of the conventional and conformal cooling systems to show the behavior of polypropylene and polyethylene inside the cooling channels.

Thermoforming Properties of TPOs

Donald Hylton
McConnell Co., Clark Atlanta University

The thermoforming behavior or commercial grades of TPO sheets were studied under conditions simulating the process. Dynamic and steady state rheological tests were used to analyze and predict behavior in the thermoforming process. The data show that rheological tests are more definitive for determining observed processing differences in TPO materials than relying on mechanical properties and Melt Flow Rate from data sheets. A term "Thermoforming Index" is introduced using short term relaxation time from steady state Rheology as an effective predictive tool.

LIGHTWEIGHTING OF POLYOLEFIN PARTS

SESSION CO-CHAIRS

John Haubert
Chrysler Group LLC

Normand Miron
Milliken

Light Weight TPOs for Automotive Applications

Roger Phillip Volmer
ExxonMobil Chemical Company

OEMs have greater focus on saving weight due to increasing fuel economy regulations. Regulatory penalties and increased competition are driving engineers to reduce weight throughout the vehicle.

Lower density TPO's that do not compromise performance will provide an essential tool in meeting weight reduction targets. This presentation focuses on potential raw materials utilized to produce lower density TPO's. Additionally, an overview of physical property performance enhancements and application specific testing will be discussed.

Developing a High-performance Interior Lightweight Polypropylene Compound

Normand Miron
Milliken

Condensed case study summarizing the technical development of a reinforced Polyolefin material, which delivers both a low density interior trim part and increased recycled content, while meeting the European OEM specifications. The Lightweight Polyolefin Compound (LPC) leverages sophisticated recycled resin formulation technology and a high performance reinforcing additive to achieve this dual objective.

LFT Technology for Car Weight Reduction

Youngbum Kim
Lotte Chemical Alabama

Long fiber thermoplastics (LFT) technology is known as the promising technology to contribute to high fuel efficiency by reducing component part weight. LFT has replaced several steel parts, such as door module, front end module, and other structural parts due to its high modulus and strength. Additionally, carbon fiber is expanding in replacing other stronger structural parts. This presentation focuses on lightweighting technologies. It also introduces Lotte Chemical's unique LFT material and associated applications.

Stiffness/Mass Optimization in Polymers Incorporating Glass Microspheres (3M) and MuCell (Trexel) Foam Injection Molding Technology

Charles Buehler
General Motors Company

Typically, polymers used for automotive have densities ranging from 0.9 (unreinforced) – 1.5 g/cc (reinforced). Synergistically incorporating glass microspheres with the MuCell process the stiffness/mass ratio of the resultant polymer can be optimized, lowering the densities of polymers to 0.8-1.2g/cc and reducing the mass of parts by 12-23% without losing stiffness. This paper will discuss results of combining glass microspheres and the MuCell process to enhance the stiffness of polymers at a lower mass.

LIGHTWEIGHTING OF POLYOLEFIN PARTS

SESSION CO-CHAIRS

John Haubert
Chrysler Group LLC

Normand Miron
Milliken

Light Weighting Solutions with Reactor Filled TPO from Flint Hills Resources

Bill Bodiford
Flint Hills Resources LP

Overview of FHR's unique capabilities to make compounded TPO's, incorporating various fillers and/or modifiers with the polymer powder directly from the reactor. Insight will be given on FHR's development process to address the needs of the OEMs at an economical cost, along with a review of the achievable physical properties of filled and unfilled materials through practical examples.

Role of Minerals in Weight Reduction Strategies for Automotive Polymers

Saied Kochesfahani
Imerys Performance Minerals and Talc

Minerals contributions to light-weighting can be divided into two categories: performance enhancement to enable redesign, metal replacement, and part down-gauging, and secondly the direct utilization of lighter materials, including polymeric foams and/or lower density minerals. This presentation will analyze the role of minerals in weight reduction strategies for automotive polymers. General benefits of minerals in reducing carbon footprint of polymers will also be presented to maximize its contribution to the sustainability of polymeric compounds.

Development of a Lightweight Trim TPO

Matthew Delaney
SABIC

To meet future fuel economy standards, automakers continue to pursue strategies to achieve mass savings. Thin-wall technology is one promising approach to not only reduce mass, but also realize manufacturing efficiencies. Integral to success is the right design and the right material. This presentation focuses on: one, the use of an innovative long glass fiber polypropylene composite material for thin-wall instrument panels, as an example; and two, state-of-the-art predictive modeling as an important design tool.

DFSS to Decrease Mass for Pillar Trim Requiring Energy Management and key Part Performance Attributes

David Helmer
General Motors Company

This presentation will review current polyolefin material for pillar trim selected for stiffness impact balance, aesthetics, and improved fit performance for holding to windshield blackout line. This DFSS evaluated five polyolefin materials and will review the following: Cost/performance analyses, Weight savings, Appearance/durability, Dimensionals, and Tensile/modulus at elevated temperature. The results will establish and summarize phase two path forward for selection of two polyolefin materials with lower mass than control to send through complete validation/deployment.

LIGHTWEIGHTING OF POLYOLEFIN PARTS

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John Haubert
Chrysler Group LLC

Normand Miron
Milliken

TPO Weight Reduction Solutions

Jason Fincher
Advanced Composites Inc.

In response to the Automotive OEMs need for light weighting solutions, Advanced Composites reviews a selection of its TPO offerings tuned to

achieving weight reduction via lower density, injection foaming or thin walling. Injection foaming compounds can achieve up to 25% weight reduction and allow Class A surface appearance. Others designed with high flow and stiffness provide an opportunity to minimize wall thickness, while others achieve equivalent stiffness / cold impact balance at lower density.

Make a Green and Light Mobility with Polypropylene

Frank Bollaert
Sumika Polymer Compounds Europe

Demands from OEMs to save weight is driving

interest in processes that allow foams to be created during molding, reducing weight/cost. Sumitomo Chemical has been developing PP compounds for those technologies. Sumika presents those innovative PP solutions which are being used to expand into Europe in two ways, adapting PP compounds to specific European requirements, for example regarding odor and VOC emissions; second by making those compounds more "green", using bio-polymers or natural fibers.

Development of a Light Weight Interior Trim TPO with improved Scratch Resistance

Joel Myers
Hyundai Kia America

With fuel efficiency targets and emission restriction regulations getting increasingly challenging

around the globe, Hyundai Kia continues to deploy resources to reduce the weight of its vehicles. This paper will go over a recent development, where Hyundai Kia has successfully integrated a new high performance reinforcement ingredient from Milliken, to develop a "drop-in" light weight interior trim compound meeting HK's material, while improving scratch resistance.

ADHESIVES & COATINGS FOR TPOs

SESSION CO-CHAIRS

Dr. Pravin Sitaram
Haartz
Dr. Laura Shereda
Asahi Kasei

PLENARY TALK: Advances in Adhesives and Coatings for TPOs

Dr. Laura Shereda, Dr. Pravin Sitaram
Asahi Kasei Plastics North America Inc., Haartz


The demand for softer interior has challenged adhesives & coating manufacturers to make improvements in their materials. Processing of soft trim is also constantly evolving. On soft TPO surfaces, new options in adhesion promoters and primers have not only simplified lamination processes, but also decreased scrap. New adhesives including the development hot melt roll coated adhesives can decrease process complexity and remove costly surface treatment steps. This presentation will give an overview of the challenges faced in soft interior trim and potential solutions available for use today.

Demystifying Adhesion Promoters

Michael Pollock
PhibroChem

The term adhesion promoter has implied some special almost mysterious technology for achieving adhesion to olefinic substrates such as polypropylene and Thermoplastic Olefin (TPO). Formulators will learn theories and applied knowledge to allow for a better understanding of the adhesion mechanism. A review of key research work helps clarify theories and demystify the mechanism of these polyolefin Adhesion Promoters. Learn critical information to help develop waterborne and solvent based products that meet regulatory needs.

Organic Coatings for Physical Performance and Aesthetics in Automotive TPO

John R. Dunn
Stahl USA

Stahl Performance Coatings has provided topcoats for TPO for over 20 years. A ground up approach to coating design provides control of the surface chemistry and morphology. From polymer design, additive incorporation and crosslinker selection superior coating characteristics can be achieved. Through optimization of compatibility in design, it is possible to provide the required tactile and performance characteristics required of the automotive industry in a surface layer no thicker than 15 microns.

Smart Coating Solutions for Thermoplastics

Mark Mandle
Etna Bechem Lubricants, Lt.

Carl Bechem GmbH (Hagen, Germany) and Etna-Bechem Lubricants, Ltd. (Chagrin Falls, Ohio) have developed and provide the automotive industry with a wide range of smart coating solutions for thermoplastics to address critical NVH issues. Employing a variety of lubricant technologies including specialized anti-friction as well as anti-squeak coatings have given parts suppliers cost effective lubricant solutions that successfully address critical performance issues related to wear and noise associated with interior, engine compartment and chassis components. These technologies and testing of same will be discussed.

ADHESIVES & COATINGS FOR TPOs

Current Trends in Lamination of TPO in the Automotive Industry

Dennis Anderson
HB Fuller

This paper will cover the direction the automotive market is moving in the use of adhesives in automotive interiors using TPO type laminates. We will look at three different adhesive types, HMPUR, HMPOR and water base adhesives. We will also review lab developed data which will show what adhesive performance should be expected after the part has been processed. Finally, we will make some adhesive recommendations for each processing category for common interior trim materials.

Streamlining the TPO Bonding Process by Eliminating "on-site" Adhesive Application

Nikki O'Brien
Nolax

This adhesive technology eliminates on-site adhesive application at the Tier 1 and thereby streamlines their production process. They save on investment, energy, personnel, and inventory costs.

In this paper, we will:

- Explain the adhesive technology
- Describe the bonding process
- Show how this new bonding technology allows Tier 1s to streamline their processes
- Describe how this adhesive contributes to light weighting
- Review the bond parameters and results of OEM testing.

Bonding and Lamination of Polyolefin Substrates

Helmut Doyen
Sika Corporation

The use of olefin substrates became very popular in the Automotive interior industry in the 80's because of the cost effectiveness of olefin plastics compared to polar substrates like ABS, Polyamides or even wood fiber.

Any polar coating, paint or adhesive for coverstocks, requires a pretreatment of the surface for durable adhesion. For lamination and assembly, Sika developed a variety of adhesives and primers to eliminate cost intense pretreatments.New Sika hot melt technologies allow preapplication to the coverstock, disconnecting the adhesive application from the lamination process.

Hot Melt AdhesiveTechnology in Automotive Polyolefin Interior Components

Dr. Thomas Hohberg
Jowat AG

TPO soft trim materials, polypropylene-based substrates, and polyolefin-based hot melt adhesives are an ideal match. This complements the general hot melt advantages including: 100% solid content, solvent- and water-free systems, no drying, reduced storage and logistic costs, high transfer efficiency without uncontrolled overspray, and long shelf life and no sensitivity to storage and shipping temperatures. Special attention will be given to the importance of part design, equipment performance, and process details.

ADHESIVES & COATINGS FOR TPOs

SESSION CO-CHAIRS

Dr. Pravin Sitaram
Haartz
Dr. Laura Shereda
Asahi Kasei

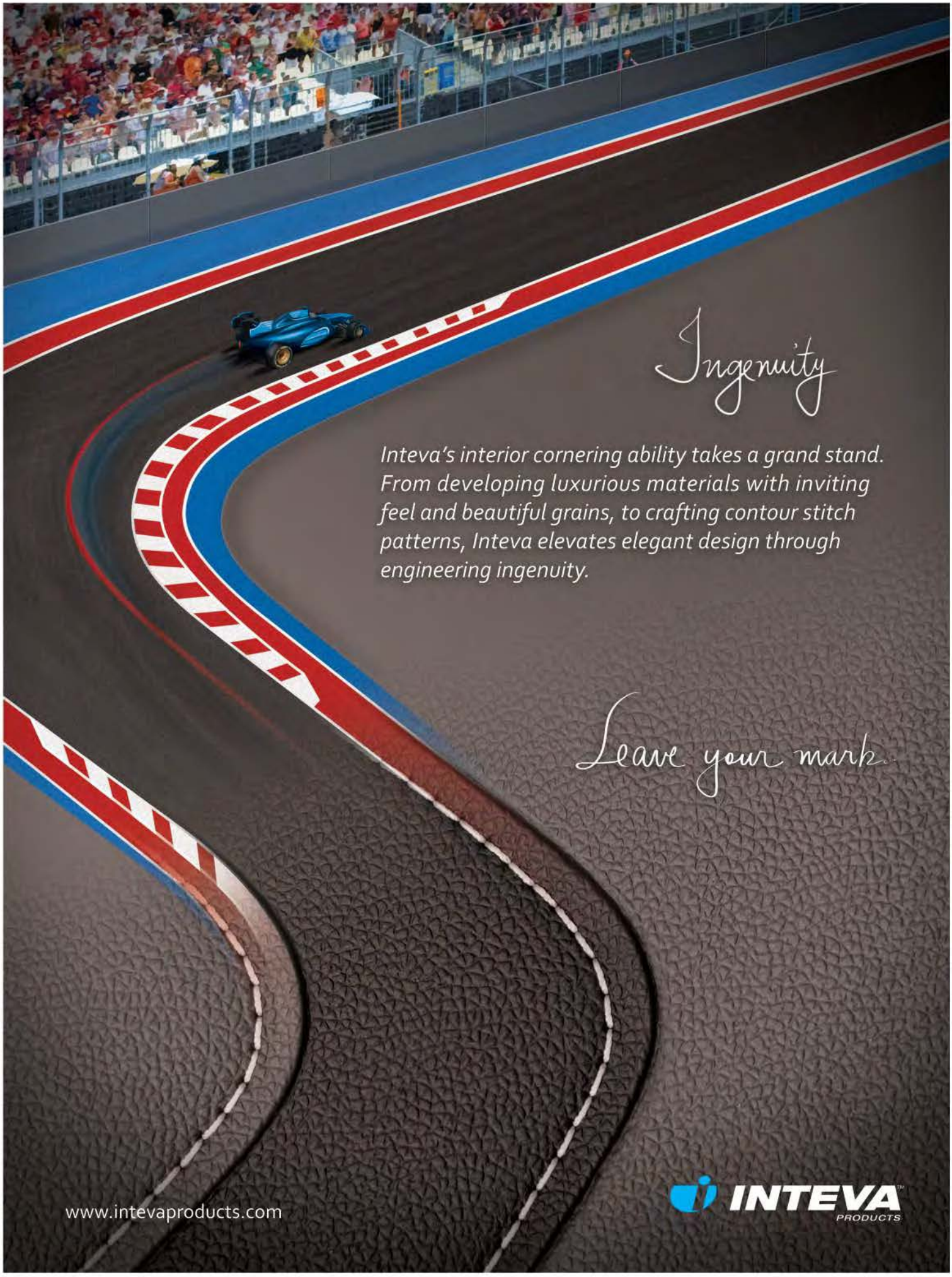
Introducing New Fully-Integrated TGA-GC-MS and TGA-FTIR Systems for Characterization of Materials Including Polymers, Petrochemicals, Biomass, and More

Robert Peiper, Ph.D.
NETZSCH Instruments LLC

Evolved Gas Analysis (EGA) is an ideal means for characterizing the thermal behavior of organic and inorganic solids or liquids in more detail and elucidating the chemistry behind them. This paper will focus on two new developments for evolved gas analysis including TGA-GC-MS and TGA-FTIR.

The primary scope of fully-integrated TGA-GC-MS coupling is to detect, separate and analyze organic components. It is also possible to use the coupled GC-MS for detailed gas analysis to further improve the temperature-programmed pyrolysis of samples such as polymers and petrochemicals in the TGA or STA (Simultaneous DSC/DTA-TGA).

The volatile products emitted during combustion processes can be determined with high sensitivity and resolution at various oxygen content levels. The fully-integrated GAFTIR system allows for analysis of decomposition, solid-gas reactions, compositional analysis, with the study of evaporation and outgassing.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China Plastic & Rubber Journal
China Plastics & Rubber Journal International
Industrias Plásticas
Modern Plastics India Magazine
The Molding Blog
Noticiero del Plástico
Plastics Technology Magazine
PLASPEC Global Plastics Selector
Plastechbiz
Plastics Engineering Magazine
Plastics: The Global Application Medium
Prototype Today
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TPE Magazine
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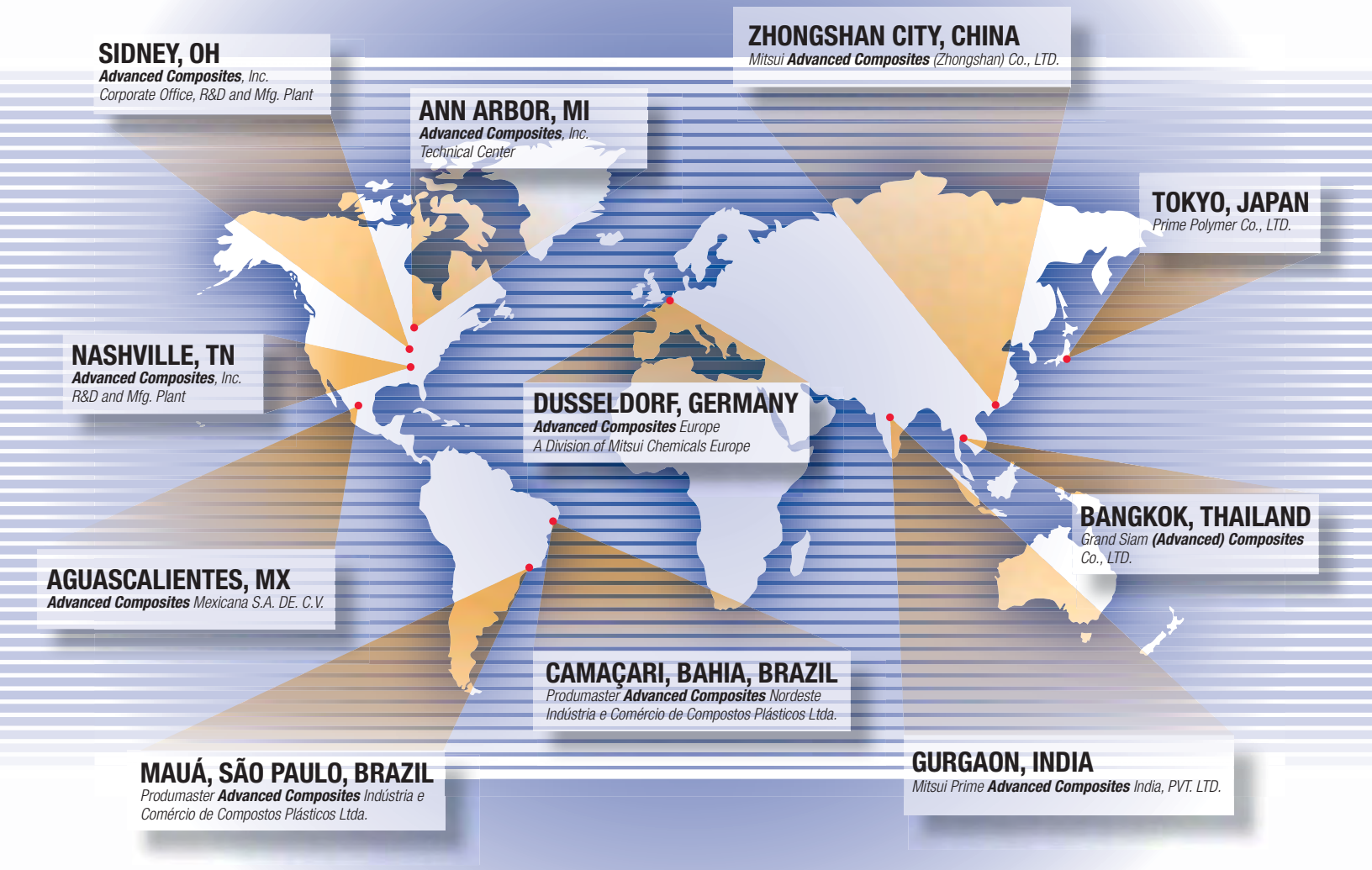
A Global Commitment to the Automotive Industry



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