



2018 SPE INTERNATIONAL POLYOLEFINS CONFERENCE

February 25 - 28, Houston, Texas

Abundant Supply = Opportunities and Challenges



Monday Afternoon

1:30 pm - 5:30 pm

Recent Advances in Additives (Salon A)

Moderator: Thoi Ho, Flint Hills Resources

"Managing" Regulatory Evaluations of Plastic Additives
David Horst, Senior Product Steward, Plastic Additives
Business Unit, BASF Corporation

Globally, there are an alphabet soup of regulatory programs that are active in evaluating chemicals for safety. The objectives can vary from completion of information requirements to exploration to proposal for ban. Timeframes can vary as well. Some of the programs affecting plastic additives are summarized. PBT (Persistent Bioaccumulative and Toxic) assessment and assessment of Endocrine Disruptive properties are two areas that are of current concern to global authorities. Some past and present experiences with evaluations are summarized at a high level. Thoughts are provided about how additive suppliers and the plastics industry can best interpret and navigate these ongoing challenges to the business.

Aspects of UV Stabilization for Thick Section Polyethylene
JungDu Kim, Technical Service Manager, SONGWON

Recent Advances in Catalysts (Salon B)

Moderator: Amaia Montoya, Grace

Moderator: Alma Dzudza, Albemarle

CONSISTA® catalyst for the UNIPOL® PP process – Six years in perspective

Manu Rego, Polyolefins Products and Analytical Science
R&D Leader, W.R. GRACE

GRACE commercialized the CONSISTA® catalyst for the UNIPOL® PP process in 2012. This paper reflects on the six years of implementation that followed and offers a unique perspective of how catalyst technology enables polypropylene producers product innovation. This paper shares unmet needs uncovered before commercialization, how catalyst technology met those unmet needs, a high level summary of PP products developed for the global polypropylene market and relevant examples.

Latest Innovations in the Borstar® PE and PP Processes
and Catalyst Technologies

2:00 pm - 2:30 pm

International Americas
 Polyethylene (PE) will breakdown when exposed to sources like, UV radiation and heat. Such degradation of PE results in undesired effects such as cracking, chalking, color change, loss of gloss, and loss of mechanical properties. Therefore, UV stabilization is necessary for all PE weatherable applications. This paper discusses the limits of the aforementioned UV stabilization strategy and proposes new synergistic UV packages, which outperforms current UV stabilizers.

Franz Langhauser, Director, Innovation and Technology,

DiAlkyl HydroxylAmine (DAHA) Anti-Oxidant as a Long Term Heat Stabilizer
 Ching Fan Chiu, Chitec Technology

Evidence of Coordinated Trimethylaluminum (TMA) in MAO as the Major Active Site and Its Quantification
 Lubin Luo, Polyolefin Catalyst Chemist, ExxonMobil Chemical
 Methylaluminoxane (MAO) is the major commercial activator supported on silica to activate metallocenes for gas-phase polyolefin production. Commercial MAO used for supported catalyst preparation is a kinetic product dissolved in toluene that can undergo gelation even under cooling environment and change its composition, e.g., increasing gel ("perfect" MAO) and free-trimethylaluminum (TMA) contents and decreasing coordinated-TMA content. Each of the MAO components shows different interaction with the support surface functional groups and the catalyst molecules, which are related not only to the catalyst activation efficiency, but also to the finished catalyst operability, e.g., fines, heat removal efficiency, and the derived resin morphology in the reactor, and the product properties, e.g., comonomer distribution profile. Among various proposed MAO active site structures and activation mechanisms, one suggests dimethylaluminum cation (AlMe_2^+) precursors in MAO as the major active sites based on the reaction of $\text{EtInd}_2\text{Zr}(\text{OMe})_2$ with MAO that forms the cationic complex $[\text{EtInd}_2\text{Zr}(\text{O}^-\text{Me})_2\text{AlMe}_2]^+$ (EtInd_2 = ethylene-bis-indenyl), where the two ^1H NMR detectable OMe leaving groups serve as a chelating agent to extract AlMe_2^+ from non-ionic MAO to form an ion-pair B as the 1st step of the activation, following an alkylation with free TMA in MAO as the 2nd step to complete the activation (Reaction I). Both free and coordinated TMA are experimentally detectable in MAO solution.¹ This contribution provides evidences of coordinated TMA in MAO as the precursor of the active species AlMe_2^+ , which

2:30 pm - 3:00 pm

is not exist in non-ionic MAO until the coordinated TMA meets e-donors such as THF or leaving groups on metallocenes, e.g., Cl or Me. The coordinated TMA amount can be quantified through the irreversible reaction of MAO with a so-called “coordinated TMA remover”, such as KF, which can quantitatively precipitate MAO as an ionic compound (D in Reaction II) to form a 2nd liquid phase (or a clathrate). Both THF extractable AlMe_2^+ concentration and the activation efficiency decrease as the KF amount increases to replace coordinated TMA. The AlMe_2^+ promoted activation mechanism can also be replicated through non-MAO strong Lewis acids with free TMA, e.g., $\text{B}(\text{C}_6\text{F}_5)_3/\text{AlMe}_3$ or $\text{Ph}_3\text{C}+\text{B}(\text{C}_6\text{F}_5)_4^-/\text{AlMe}_3$. These systems, unable to form AlMe_2^+ without the present of e-donors similar to MAO, are capable of providing AlMe_2^+ for non-alkylated metallocene activation following the path of Reaction I.2c) Other “coordinated TMA remover” and “coordinated TMA regenerator” compounds are presented and discussed.

3:00 pm - 3:30 pm

Break (Atrium)

3:30 pm - 4:00 pm

Novel Antioxidant Solutions for Polypropylene with Enhanced Colour Performance
Warren Ebenezer, Applications Research Manager, Addivant

The stability of polypropylene is typically measured as the results of colour and melt stability determined after multipass extrusion. Both properties are critical, but colour development is a visual representation or proxy of potential stability issues. When a customer first sees a resin they cannot tell how melt stable the resin is, they can, “determine the stiffness or impact resistance of the polymer, what they assess is colour. If the colour is different from their expectation, the thought is that the colour shift may be an indication of a potential quality issue. Polymer producers and stabilization providers strive to maintain colour control that is consistent throughout the life cycle of the polymer. The advent of new catalyst systems and technologies can confound the color generation of a given, well established stabilization chemistry. Scientists at Addivant have been investigating the color shift phenomenon and have developed a new patented concept leading to stabilization

High Performance PP Products with Non-Phthalate Catalyst
C.P. Cheng, Product Manager, Polyolefin Catalysts, Clariant
In 2013, Clariant and CBI Novolen joint forces to develop new catalysts for propylene polymerization. A 4th generation Ziegler Natta catalyst having improved catalyst morphology, activity and kinetics behavior was commercialized 2015. Now a new generation non-phthalate catalyst has been developed and being commercialized. This new catalyst system provides even higher catalyst activity and excellent hydrogen response, and can produce polymer with very high isotacticity not attainable with phthalate catalysts. These properties allow the production of high performance products, especially random and impact copolymers, and expand the entire product envelope. The characteristics and properties of the new generation catalyst will be discussed, together with examples of the high performance products produced with the new catalyst.

solutions which deliver substantial improvements in colour performance for polypropylene relative to the state of the art. Data will be presented to demonstrate these effects

The Long-Term Stabilization of Polyolefins Demanding Applications

Niall Marshall, Everspring Middle East WLL

For many applications the stabilization of polymers is taken for granted. The polymer can be processed without damaging the mechanical properties and the product retains its mechanical integrity and appearance for the service life of the plastic object – weeks, months or years. Advances in catalyst and polymerization technology are allowing the development of new polyolefins which have properties allowing them to be used in new and more demanding applications than previous generations of polymer. Examples of such demanding applications include pipes, dam-liners, cables and geomembranes where they are expected perform for decades even in harsh environments with high ambient temperatures exposed to sunlight and in contact with extractive media and, for these applications, it is important to both revisit the first principles of antioxidant selection and to benefit from recent advances in the formulation of stabilization systems.

Cycloalkyl-Bridged Metallocene Compounds and their Use as Catalysts for Olefin Polymerization

Jeremy Praetorius, Chevron Phillips Chemical

A large amount of literature exists highlighting the structure/activity relationships between metallocene catalysts and the polymers they produce. This is of great commercial importance for the development of advanced applications, as to be useful the catalyst must meet many requirements with respect to how it behaves with catalyst activator supports such as mMAO, monomer, co-monomers and chain terminating reagents such as hydrogen. For a metallocene, the simple modification of tethering the two cyclopentadienyl rings together can have profound effects on these interactions and thus, the polymer it produces. Furthermore, the identity of the bridging atom(s) and its substituents also influence these results. The following talk will highlight a series of ansa-metallocene structures featuring cycloalkyl groups and their use in ethylene and ethylene/1-hexene polymerizations. When used in combination with solid acid activators these catalysts show a variety of unique behaviors compared to their acyclic counterparts. The presence of the cycloalkyl-bridge affects a variety of important polymer properties including incorporation of 1-hexene co-monomer, molecular weight and molecular weight distribution, and long chain branching.

Unexpected Performance Improvements with a New Class of Liquid Polymeric Phosphites

Jacob Lance, Dover Chemical

Phosphites are widely known to act as secondary antioxidants and are added to most polyolefin formulations to protect the polymer during melt processing. However there are additional unexpected benefits that have been observed with a new class of polymeric phosphite stabilizers. This paper will discuss some of these unexpected improvements including NO_x stability, gamma irradiation, and decreased melt fracture during film extrusion.

New and Improved Post-Metallocene Polyolefin Catalysts

Philip Fontaine, The Dow Chemical Company

Molecular polyolefin catalysts continue to have a large industrial impact in the growing polyolefin market. With continuing increase in product demand, new and differentiated catalysts are sought which can impart material and/or process improvements relative to the existing technology. The discovery of new catalysts involves expedient research approaches, and the subsequent streamlining of synthetic methods. Our research focuses on the development of modular frameworks, and robust synthetic methods, in order to expedite discovery and facilitate the large scale production

4:00 pm - 4:30 pm

4:30 pm - 5:00 pm

of new polyolefin catalysts. Examples highlighting key aspects of this process will be described, including the development of advantaged catalysts, and the optimization of synthetic methods to produce key synthetic targets.

5:00 pm - 5:30 pm

Influence of Additives on Processing of Cast Films and Tapes

Tad Finnegan, Technical Manager, Plastic Additives
Regional Application Center, BASF Corporation

The selection of the components of a stabilization package can impact the throughput and processing efficiency during production of cast films and tapes. One manner in which this impact can manifest is in the water carry-over behavior, where water used to quench the film / tape clings to the polymer surface. High water carry-over forces the converter to reduce the line speed to prevent defects and limiting the overall throughput. In this paper we review the influence of additive systems on water carry-over behavior and introduce an optimized light stabilizer blend that minimizes this behavior.

5:30 pm - 7:30 pm

Welcoming Reception--Sponsored by PMC (Donatello Ballroom Upstairs)