METALLOCENE-
CATALYZED POLYMERS

Materials, Properties, Processing & Markets

George M. Benedikt
Brian L. Goodall

Society of Plastics Engineers
Plastics Design Library
TABLE OF CONTENTS

Foreword
  George M. Benedikt and Brian L. Goodall v

Materials
Economic Factors for the Production of Metallocene and Perfluorinated Boron Cocatalysts 1
  Jeffrey M. Sullivan
Polypropylene Reinvented - Cost of Using Metallocene Catalysts 11
  Norman F. Brockmeier
New Approaches for Ziegler-Natta Catalysts for Polypropylene 21
  Edward S. Shamshoum and David Rauscher
UNIPOL® Gas Phase Copolymerization with SSC Metallocene Technology 35
  Frederick J. Karol
High-Molecular-Weight Atactic Polypropylene from Metallocene Catalysts. Influence of Ligand Structure and Polymerization Conditions on Molecular Weight 43
  Luigi Resconi, Fabrizio Piemontesi, and Robert L. Jones
Homo- and Co-polymers Derived from Multicyclic Olefin Monomers: The Quest for Higher T_g Materials 57
  George M. Benedikt, Brian L. Goodall, Lester H. McIntosh III, Larry F. Rhodes, Louis M. Wojcinskill
The Renaissance in Polyolefin Manufacturing Technology 63
  Kenneth B. Sinclair
Mixed Metallocenes for Designer Polymers 73
  A. N. Speca and J. J. McAlpin
Advances in the Functionalized Polyolefins Synthesis and Applications 81
  T. C. Chung
SPS Crystalline Polymer: A New Metallocene-catalyzed Styrene Engineering Thermoplastic 89
  Robert Brentin, David Bank, and Michael Hus
Ethylene/a-olefin Copolymers with Metallocene Catalysts in High Pressure Process 97
  Akihiro Yano and Akira Akimoto
Semicrystalline Polyolefins - Narrow MWD and Long Chain Branching: Best of Both Worlds 103
  Joao B.P. Soares and Archie E. Hamielec
Structure and Properties of Single Site Constrained Geometry Ethylene-Propylene-Diene, EPDM, Elastomers 113
  D. R. Parikh, M. S. Edmondson, B. W. Smith, J. M. Winter
  M. J. Castille, J. M. Magee, R. M. Patel, and T. P. Karajala
Enhancing Polyethylene Performance with INSITE® Technology and Molecular Design 121
  Kaelyn C. Koch and Bill Van Volkenburgh

Properties
Morphological Investigation on Very Low Density Ethylene-Octene Metallocene Copolymers Using SAXS 127
  Paul J. Phillips and Kenneth Monar
Further Studies on Metallocene ULDPE/PP Blends Impact-Morphology Relationships 135
S. P. Westphal, M. T. K. Ling, S. Y. Ding, and L. Woo

Morphology of Low to Very Low Density Ethylene-Octene Metallocene Copolymers 141
P. J. Phillips and K. Monar

Morphological Studies of Metallocene Plastomer Modified Polypropylenes 149
N. R. Dharmarajan and Th. C. Yu

Comparison of the Crystallization Behavior of Ziegler-Natta and Metallocene Catalyzed Isotactic Polypropylene 157
E. B. Bond and J. E. Spruiell

Explaining the Transient Behaviors of Syndiotactic Polypropylene 163
W. R. Wheat

Equilibrium Melting Temperatures of Ethylene Copolymers: An Appraisal of the Applicability of the Flory and Sanchez-Eby Approaches 169
Man-Ho Kim and P. J. Phillips

Melt Rheology and Processability of Ethylene/Styrene Interpolymers 177
Teresa Plumley Karjala, Y. W. Cheung, and M. J. Guest

Characterizing the Melt Relaxation Behavior of Metallocene Polyethylenes 185
S. H. Wasserman

Studies on the Thermal Stability and Processability of Syndiotactic Polystyrene 193
Ch.-M. Chen, H.-R. Lee, Ch.-J. Wu, H.-M. Chen

G. J. Klenner, R. A. Hendriks, J. Semen, and K. P. Becnel

Metallocene Plastomer Modification of Clear Polypropylene for Impact Enhancement 209
Th. C. Yu and Donna S. Davis

Frictional Behavior of Polyethylenes with Respect to Density and Melting Characteristics 215
Y. S. Kim, C. I. Chung, S. Y. Lai, and K. S. Hyun

Crystallinity Dependence of Modulus and Yield Properties in Polyethylenes 225
J. Janzen and D. F. Register

Processing

Processing Characteristics of Metallocene Propylene Homopolymers 231
C. Y. Cheng and J. W. C. Kuo

Performance - Property of Novel Glass Fiber Reinforced Polypropylene Compounds and Their Applications 239
P. Dave, D. Chundury, G. Baumer, and L. Overley

Injection Molding of Glass Fiber Reinforced Syndiotactic Polystyrene 247
Ch.-M. Hsiung, S. Zhang, and D. Bank

Injection Molding Optimization Procedures for Polyolefin Plastomers and Elastomers 253
S. Hoenig, Wendy Hoenig, and K. Parsely

Potential Film Applications of Metallocene-based Propylene Polymers from Exxpol® Catalysis 261
A. K. Mehta, M. C. Chen, and J. J. McAlpin
## Table of Contents

Effect of Various Polyethylene Structures on Film Extrusion  
*C. M. Wong, H. HShih, and C. J. Huang*  
An Innovative Approach to Understand Metallocene Based Polyolefins and Thermoplastic Resins for Film Applications  
*N. S. Ramesh and Nelson Malwitz*  
Extrusion Behavior of Exxpol Metallocene Polypropylene  
*C. Y. Cheng*  
The Effects of Long Chain Branching on the Processing-Structure-Property Behavior of Polyethylene Blown Film Resins  
*A. M. Sukhadia*  
Spherilene Process LLDPE for Conventionally Blown Shrink Film  
*T. J. Cowell*  
Blown Film Characterization of Metallocene Resins Made in the Phillips Slurry Loop Process  
*A. M. Sukhadia*  
Comparison of the Fiber-Spinning Properties of Ziegler-Natta and Metallocene Catalyzed Polypropylene  
*E. Bryan Bond and J. E. Spruiell*  
Metallocene Linear Low Density Polyethylene Blends for Pouch Materials in High-Speed Hot-Liquid Filling Process  
*T. Tomatsuri, N. Sekine, and N. Furusawa*  
Blends of SIS Block Copolymers with Ultralow Density Polyethylenes  
*D. M. Bigg*  
Preparation of Metallocene Plastomer Modified High Flow Thermoplastic Olefins  
*Thomas C. Yu*  

### Markets

Metallocene Capabilities Drive Success of Innovative Packaging Manufacturer  
*D. C. Fischer*  
Impact of Technology on Global Polyethylene Technology  
*D. F. Bari*  
Impact of Metallocene Based Polypropylene on Existing Polypropylene Technologies and Markets  
*E. Shamshoum and J. Schardl*  
New Polyethylenes for Targeted Performance Based Applications  
*Pradeep Jain, P. J. Lonnie, G. Hazlitt, and J. A. DeGroot*  

### Index

*381*