

CHEMSYSTEMS POPS PROGRAM

Supplement I Bimodal HDPE

PolyOlefins Planning Service Report

February 2009



Griffin House, 1st Floor South, 161 Hammersmith Road, London W6 8BS, UK
Tel: +44 20 7950 1600 Fax: +44 20 7950 1550

This Report was prepared by Nexant, Inc ("Nexant") and is part of the PolyOlefins Planning Services Program (POPS). Except where specifically stated otherwise in this Report, the information contained herein is prepared on the basis of information that is publicly available, and contains no confidential third party technical information to the best knowledge of Nexant. Aforesaid information has not been independently verified or otherwise examined to determine its accuracy, completeness or financial feasibility. Neither NEXANT, Subscriber nor any person acting on behalf of either assumes any liabilities with respect to the use of or for damages resulting from the use of any information contained in this Report. Nexant does not represent or warrant that any assumed conditions will come to pass.

The Report is submitted on the understanding that the Subscriber will maintain the contents confidential except for the Subscriber's internal use. The Report should not be reproduced, distributed or used without first obtaining prior written consent by Nexant. Each Subscriber agrees to use reasonable effort to protect the confidential nature of the Report.

Copyright © by Nexant Inc. 2009. All rights reserved.

Contents

Section	Page
1 Executive Summary	1-1
2 Introduction	2-1
2.1 OVERVIEW	2-1
2.2 BIMODAL HDPE PROPERTIES	2-2
2.3 APPLICATIONS	2-4
2.3.1 Film	2-4
2.3.2 Pipe.....	2-4
2.3.3 Blow Moulding	2-6
2.3.4 Other Applications	2-6
3 Technology	3-1
3.1 INTRODUCTION.....	3-1
3.2 DEDICATED HDPE BIMODAL CAPABLE PROCESS	3-2
3.2.1 Ziegler Slurry Processes.....	3-2
3.2.2 Hostalen Process	3-2
3.2.3 Equistar-Maruzen Process.....	3-7
3.2.4 MITSUI CX Process	3-11
3.2.5 Slurry Loop Technology	3-16
3.3 LLDPE/HDPE SWING PROCESS WITH BIMODAL CAPABILITY	3-20
3.3.1 Borealis BORSTAR	3-20
3.3.2 Univation's UNIPOL™ PE Process	3-22
3.3.3 LyondellBasell's SPHERILENE Process	3-24
4 Market Analysis	4-1
4.1 OVERVIEW	4-1
4.2 BIMODAL HDPE MARKET	4-4
4.2.1 Capacity	4-4
4.2.2 Demand	4-9
Appendix	Page
A Regional Bimodal HDPE Demand.....	A-1

Figure		Page
2.1	Advantages of Bimodal Polyethylene	2-3
3.1	<i>Hostalen</i> HDPE Process, Reactor and Separation Sections	3-6
3.2	Equistar-Maruzen HDPE Process, Reactor System	3-9
3.3	Equistar-Maruzen HDPE Process, Separation System.....	3-10
3.4	Mitsui CX HDPE Process, Reactor and Recovery Systems	3-15
3.5	INNOVENE S Slurry HDPE Process, Reactor System	3-19
4.1	Bimodal HDPE Capacity	4-1
4.2	Bimodal HDPE Technology.....	4-2
4.3	Installed HDPE Capacity by Technology	4-4
4.4	HDPE Capacity Growth by Technology	4-5
4.5	Global Dedicated HDPE Capacity	4-6
4.6	Global Swing HDPE Bimodal Capable Capacity by Technology	4-7
4.7	Global HDPE Capacity	4-8
4.8	Global Bimodal HDPE Demand	4-9
4.9	Regional Bimodal HDPE Demand.....	4-11
4.10	North America HDPE Demand	4-12
4.11	North America Bimodal HDPE Demand	4-13
4.12	Western Europe HDPE Demand	4-15
4.13	Western Europe Bimodal HDPE Demand	4-16
4.14	Japan HDPE Bimodal Share of Demand by Application, 2008	4-20
4.15	China Bimodal HDPE Demand.....	4-22
4.16	Chinese Bimodal HDPE Demand by Application, 2008	4-22
4.17	South Korea HDPE Demand.....	4-24
4.18	Indian Bimodal HDPE Demand	4-25

Table		Page
2.1	ISO Standard Classification of Pipes	2-5
3.1	<i>Hostalen</i> HDPE Plants	3-3
3.2	Equistar-Maruzen HDPE Plants.....	3-7
3.3	CX HDPE Plants	3-12
3.4	INNOVENE S (Solvay) HDPE Plants	3-17
3.5	BORSTAR HDPE Plants	3-20
4.1	Dedicated HDPE Capacity Additions by Region.....	4-6
4.2	North American HDPE Bimodal Capable Capacity	4-15
4.3	Western Europe HDPE Bimodal Capable Capacity.....	4-18
4.4	Japanese HDPE Bimodal Capable Capacity	4-19
4.5	China Bimodal HDPE Capacity	4-21
4.6	South Korea HDPE Bimodal Capable Capacity	4-24
4.7	Indian HDPE Bimodal Capable Plant Capacity	4-25