

PERP Report

Polypropylene

02/03-3

August 2003



44 South Broadway, White Plains, New York 10601, USA
Tel: +1 914 609 0300 Fax: +1 914 609 0399

Contents

Section	Page
1 Executive Summary	1
1.1 STRATEGIC ISSUES	1
1.1.1 Development Trends	1
1.1.2 Technology Markets	2
1.1.3 Industry Drivers	3
1.1.4 Interpolymer Competition	3
1.1.5 Influence of Olefins	4
1.1.6 Trends and Drivers	5
1.2 TECHNOLOGY	7
1.3 COMMERCIAL	9
2 Technology Review	16
2.1 INTRODUCTION	16
2.2 GAS PHASE PROCESSES	17
2.2.1 BP (INNOVENE)	17
2.2.2 Chisso	27
2.2.3 Dow (UNIPOL PP)	32
2.2.4 Novolen Technology Holdings (NOVOLEN)	42
2.2.5 Sumitomo	49
2.3 BULK PROCESSES	53
2.3.1 Basell (SPHERIPOL)	53
2.3.2 Mitsui Chemicals (HYPOL II)	62
2.3.3 Borealis (BORSTAR)	68
2.4 IMPROVED SLURRY PROCESS	72
2.4.1 Recent Developments/Background	72
2.4.2 Process Description	72
3 Technology Developments	76
3.1 PRODUCT PERFORMANCE	76
3.2 PROCESS TECHNOLOGY	76
3.3 PROCESS CHEMISTRY	78

4	Economic Analysis	81
4.1	RAW MATERIALS AND UTILITIES	81
4.2	TECHNOLOGY ASSESSMENT	81
4.2.1	Homopolymer	82
4.2.2	Impact Copolymer	83
5	Commercial Analysis	85
5.1	GLOBAL OVERVIEW	85
5.1.1	Demand	85
5.1.2	Supply	86
5.1.3	Trade	87
5.1.4	Supply/Demand and Trade Balance	89
5.2	UNITED STATES	91
5.2.1	Demand	91
5.2.2	Supply	93
5.2.3	Supply/Demand and Trade Balance	98
5.3	WESTERN EUROPE	100
5.3.1	Demand	100
5.3.2	Supply	101
5.3.3	Supply/Demand and Trade Balance	101
5.4	JAPAN	106
5.4.1	Demand	106
5.4.2	Supply	106
5.4.3	Supply/Demand and Trade Balance	108
5.5	ASIA PACIFIC	108
5.5.1	Introduction	108
5.5.2	Demand	108
5.5.3	Supply	109
5.5.4	Supply/Demand and Trade Balance	110

Appendix	Page
A Cost of Production Estimates – Homopolymer	A-1
B Cost of Production Estimates - Copolymer	B-1
C Economic Basis	C-1

Figure	Page
1.1 Polypropylene Capacity (Installed) by Technology	6
1.2 Cost of Production – Homopolymer Polypropylene.....	8
1.3 Cost of Production – Impact Copolymer Polypropylene.....	8
1.4 Global Polypropylene Demand by Region	10
1.5 Global Polypropylene Demand by End-Use, 2002.....	11
1.6 Global Polypropylene Capacity by Region	12
1.7 Global Polypropylene Net Trade by Region.....	13
1.8 Global Polypropylene Supply/Demand Balance	15
2.1 Polypropylene Capacity (Installed) by Technology	16
2.2 INNOVENE Polypropylene Gas Phase Process.....	20
2.3 INNOVENE Copolymer Gas Phase Process	21
2.4 INNOVENE Polypropylene Process - Pelletizing.....	22
2.5 Polypropylene Process – Typical Pellet Storage and Packaging.....	23
2.6 Chisso Polypropylene Gas Phase Process	30
2.7 Chisso Copolymer Gas Phase Process.....	31
2.8 UNIPOL Polypropylene Fluidized Gas Phase Process.....	38
2.9 UNIPOL Polypropylene Process – Purge and Recovery.....	39
2.10 UNIPOL Polypropylene Process - Pelletizing.....	40
2.11 NOVOLEN Polypropylene Gas Phase Process	47
2.12 NOVOLEN Polypropylene Process - Pelletizing	48
2.13 Sumitomo Polypropylene Fluidized Gas Phase Process.....	52
2.14 SPHERIPOL Polypropylene Loop Reactor Process.....	58
2.15 SPHERIPOL Copolymer Process and Monomer Recovery	59
2.16 Typical Polypropylene Pelletizing Process.....	60
2.17 Mitsui HYPOL II Polypropylene Bulk Process.....	66
2.18 Mitsui Polypropylene Pelletizing Process	67
2.19 BORSTAR Polypropylene Process – Feed and Polymerization.....	70
2.20 BORSTAR Polypropylene Process – Copolymer Reactor and Recovery.....	71
2.21 Polypropylene Slurry Process – Polymerization and Monomer Recovery.....	73

2.22 Polypropylene Slurry Process – Atactic Removal, Drying and Solvent Recovery	74
3.1 SPHERIZONE and SPHERIPOL Property Envelopes.....	77
4.1 Cost of Production Comparison for Homopolymer Polypropylene	83
4.2 Cost of Production Comparison for Impact Copolymer Polypropylene.....	84
5.1 Global Polypropylene Demand by Region	85
5.2 Global Polypropylene Demand by End-Use, 2002.....	86
5.3 Global Polypropylene Capacity by Region	88
5.4 Global Polypropylene Regional Trade Pattern	89
5.5 Global Polypropylene Supply/Demand and Trade Balance	90

Table	Page
1.1 Global Polypropylene Demand by Region	9
1.2 Global Polypropylene Demand by End-Use.....	10
1.3 Global Polypropylene Capacity(1) by Region.....	11
1.4 Global Polypropylene Net Trade by Region.....	13
1.5 Global Polypropylene Supply/Demand and Trade Balance	14
2.1 Polypropylene Plants Using INNOVENE Gas Phase Technology(1).....	19
2.2 Polypropylene Plants Using Chisso’s Gas Phase Technology(1).....	28
2.3 Polypropylene Plants Using UNIPOL Gas Phase Technology(1).....	35
2.4 Polypropylene Plants Using NOVOLAN Gas Phase Technology(1)	45
2.5 Polypropylene Plants Using Sumitomo’s Technology	50
2.6 Sumitomo’s Polypropylene Grades	50
2.7 Polypropylene Plants Using SPHERIPOL Technology	55
2.8 Polypropylene Capacity Based on HYPOL Technology.....	64
4.1 Raw Material and Utility Prices and Labor Rates	81
4.2 Cost of Production Estimates for Homopolymer Polypropylene	82
4.3 Cost of Production Estimates for Impact Copolymer Polypropylene.....	84
5.1 Global Polypropylene Demand by Region	85
5.2 Global Polypropylene Demand by End-use.....	86
5.3 Global Polypropylene Capacity(1) by Region.....	87

5.4	Global Polypropylene Net Trade by Region.....	87
5.5	Global Polypropylene Supply/Demand and Trade Balance	90
5.6	U.S. Polypropylene Demand by End-Use.....	91
5.7	U.S. Polypropylene Demand by End-Use.....	92
5.8	U.S. Polypropylene Capacity.....	95
5.9	U.S. Polypropylene Capacity.....	97
5.10	U.S. Polypropylene Supply/Demand and Trade Balance	99
5.11	U.S. Polypropylene Supply/Demand and Trade Balance	99
5.12	West European Polypropylene Demand by End-Use	100
5.13	West European Polypropylene Capacity	102
5.14	West European Polypropylene Supply/Demand and Trade Balance.....	105
5.15	Japanese Polypropylene Demand by End-Use	106
5.16	Japanese Polypropylene Capacity.....	107
5.17	Japanese Polypropylene Supply/Demand and Trade Balance.....	108
5.18	Asian Pacific Polypropylene Demand by End-Use	109
5.19	Asian Pacific Polypropylene Demand by Country	109
5.20	Asian Pacific Polypropylene Capacity by Country	110
5.21	Asian Pacific Polypropylene Supply/Demand and Trade Balance.....	110