

CHEMICAL PROFILE

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Polypropylene

USES

Polypropylene (PP) is one of the most versatile thermoplastic polymers available commercially. Mixtures of propylene and other monomers, especially ethylene form a wide range of co-monomers. PP is processed into film, for packaging and into fibers for carpets and clothing. It is injection molded to articles from car parts to containers, and can be extruded into pipes.

About 62% of global PP is produced as co-polymer. Some 52% of PP is processed through extrusion with end uses consisting of 24.5% fibers/filaments in carpet backing, 18.5% films/sheets in food packaging, 3.3% in taps (raffia), 2.7% sheets in other types of packaging, 1.2% in yarns, and 1.8% in wires/cables and coatings for appliances. Furthermore, 45% of PP goes through injection molding with applications of 10% in automobile parts, 9% in furniture, 5.1% in crates/pales, 4.9% in corrugated boards, 4.1% in DVD boxes, 3.9% in swage/drain pipes, 3% in toys, 2.9% in housewares, and 2% in electronic cables. Finally, 3% is used through blow molding for containers/closures.

PP is commercially available as *isotactic*, *syndiotactic* and *atactic*. However, the isotactic type containing 1-5% atactic material dominates the market.

SUPPLY/DEMAND

Global capacity for PP stood at 61.4m ton/year in 2013, 40% in Asia Pacific, 15.5% in Western Europe, 14.3% in Asia/Middle East, 12.3% in the US, 5.2% in Japan, 4.8% in Latin America and 4.2% in Eastern Europe and 2.1% in Africa. China is the largest producer in the world with a capacity of 14.8m ton/year. China is also the biggest PP consumer with 13.9m ton/year, followed by Western Europe with 8.6m ton/year, 7.2m ton/year in the US, 7.5m ton/year in Asia Pacific (excluding China), 4m ton/year in Asia/Middle East, 2.9m ton/year in Eastern Europe, 2.6m ton/year in Japan, 1.3m ton/year in Africa and between 0.6-1.3m ton/year in other regions.

PRICING

The price of PP depends on its grade. Homopolymer injection grade in the US was negotiated between \$1.80-1.90/kg during September 2014. The co-polymer grade was agreed at \$1.83-1.92/kg. Homopolymer injection grade in Germany and China at the period were €1.39-1.42/kg and ¥10.1-10.5/kg, respectively.

TECHNOLOGY

There are two major polymerization processes for the production of PP. The old technology uses Ziegler-Natta catalysts. These are produced by interaction of titanium (IV) chloride and an aluminum alkyl, such as triethyl aluminum. In the bulk process, polymerization takes place in liquid propylene, in the absence of a solvent at a temperature of 340-360 K and pressures of 30-40 atm. After polymerization, solid polymer particles are separated from liquid propylene, which is then recycled. In the gas phase process, a mixture of propylene and hydrogen is passed over catalyst bed at 320-360 K and a pressure of 8-35 atm. The polymer is separated from the gaseous propylene and hydrogen using cyclones and the unreacted gas is recycled. The catalyst remains in the product and needs to be destroyed using water or alcohols, before the polymer is converted into pellets.

In the newer technology, metallocenes are being increasingly used as catalysts for the production of polypropylene. These are strictly defined as molecules which have a transition metal atom bonded between two cyclopentadienyl or related ligands which are in parallel planes. One such metallocene is based on zirconium in conjunction with an organoaluminium compound. As with the Ziegler-Natta catalysts, the bulk or gas phase can be used. In both catalyst types slurry process can also be employed. Metallocenes also catalyzes the production of co-polymers of propylene and ethylene.

OUTLOOK

Global demand growth is forecast at 5.5%/year to 2018, the highest growth rates being expected in China (8.5%/year) and Asia/Middle East (7%/year). The growth rate in Africa, Latin America, Eastern Europe and Mexico will be in 3-4%/year range. The US and Western Europe will grow at a rate of 2-2.5%/year, with Japan with the lowest growth rate of 1.5%/year.

The market continues to face challenges concerning the supply and price of propylene feedstock. Volatility in the propylene market is transferred directly to the PP market through monomer-based formula pricing. The market will find relief as more on-purpose propylene, propane dehydrogenation and methanol to olefin plants, come on stream. Considering announced new PP plants and expansions, no shortage of PP is expected through 2018.

MAJOR GLOBAL POLYPROPYLENE CAPACITY, '1000 TON/YEAR^(*)

Company	Location	Capacity	Capacity ^(**)
Advanced Petrochemical	Al Jubail, Saudi Arabia	450	
Advanced Petrochemical-Bayegan jv	Turkey		500 ⁽¹⁾
Ahhuai Huaihua	Zhongwei, China		490 ⁽¹⁾
Borealis	Burghausen, Germany	570	
	Kallo, Belgium	605	
	Schwechar, Austria	450	
Borouge	Ruwais, Abu Dhabi	800	

BP-Sinopec Shanghai Petrochemical	Shanghai, China	250	
Braskem	Freeport, TX, USA	320	
	La Porte, TX, USA	390	
	Marcus Hook, PA, USA	345	
	Paulinia, Brazil	350	
	Schkopau, Germany	445	
	Triunfo, Brazil	875	
Carmel Olefins	Haifa, Israel	450	
China National Coal	Shaanxi, China		300 ⁽¹⁾
CNPC (Dalian Fujia)	Dalian, China	300	
(Dalian Petrochemical)	Dalian, China	320	
(Daqing)	Daqing, China	600	
(Dushanzi Refinery)	Dushanzi, China	690	
(Fushun Petrochemical)	Fushun, China	390	
(Heilongjiang Qihua)	Heilongjiang, China	300	
(Lanzhou Refinery)	Lanzhou, China	340	
Dangote Group	Lekki FTZ, Nigeria		600 ⁽¹⁾
Datang International	Inner Mongolia, China	460	
Di Arya Polymer Company	Khomein, Iran		300 ⁽¹⁾
Egyptian Propylene & Polypropylene	Port Said, Egypt	350	
ExxonMobil	Jurong Island, Singapore	450	900 ⁽²⁾
	Baton Rouge, LA, USA	400	
	Baytown, TX , USA	800	
	Lillebonne, France	440	
Flint Hills	Longview, TX, USA	350	
Formosa	Mailiao, Taiwan	540	
	Kaohsiung (Lin Yuan), Taiwan	400	
	Ningbo, China	450	
	Point Comfort, TX, USA	860	
Fujian Refining & Petrochemical	Quanzhou, China	520	
GS Caltex	Yeosu, South Korea	450	
Haldia Petrochemical	Haldia, India	340	
Hebei Haiwei	Hengshui city, China		600 ⁽¹⁾
HMC Polymers	Map Ta Phut, Thailand	750	
Lotte Chemical	Daesan, South Korea	1100	
HPCH-HMEL	Bathinda, India		440 ⁽¹⁾
Huajin Chemical	Lianing, China	300	
IBN Zahr Saudi-European Petrochemical Company	Al Jubail, Saudi Arabia	1140	
Inderpro (LyondellBasell-Alfa jv)	Altamira, Mexico	240	590 ⁽²⁾
Indian Oil	Panipat, India	700	
Ineos	Lavera, France	300	
	Chocolate Bayou, TX, USA	440	
	Geel , Belgium	500	

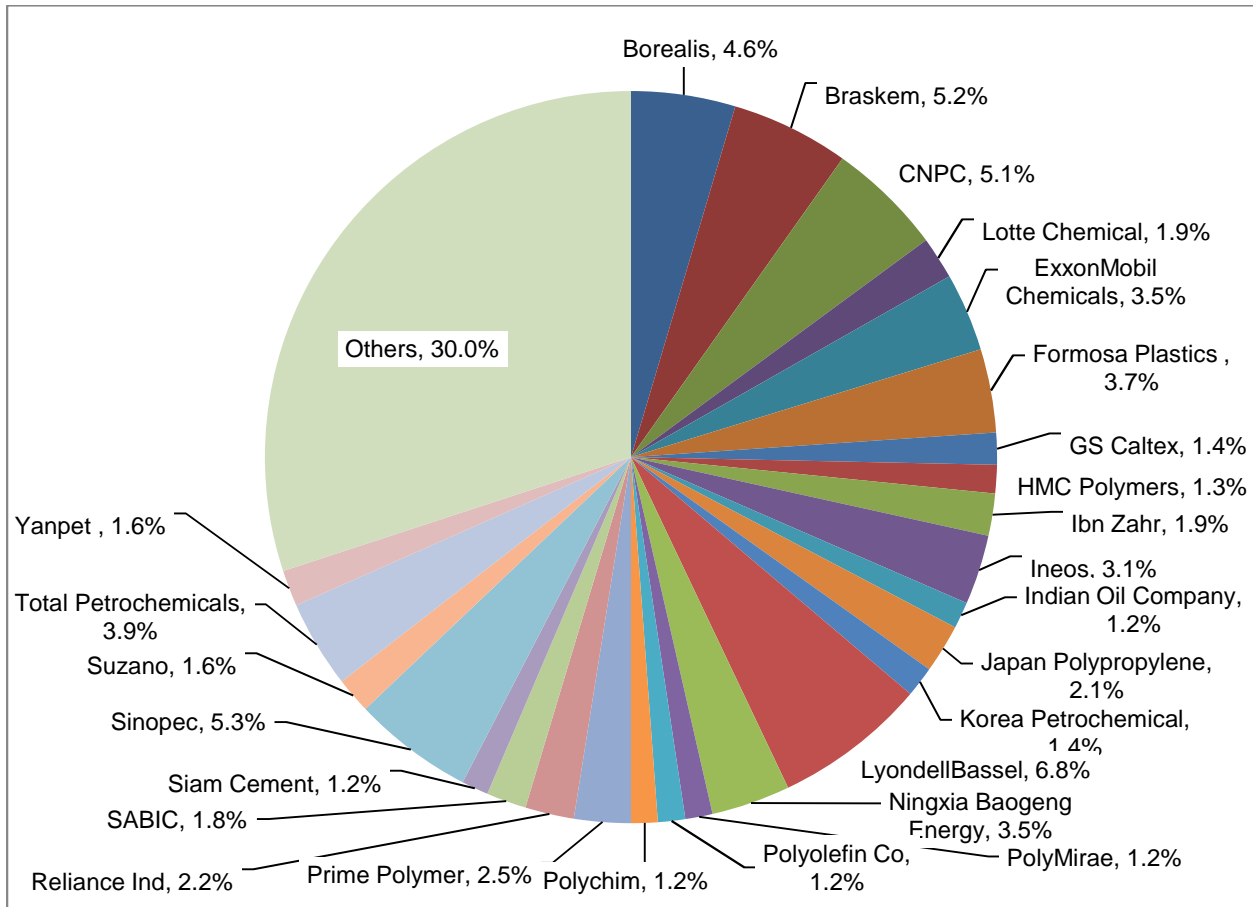
	Grangemouth, England	285	
Jam Petrochemical	PSEZ, Iran	300	
Japan Polypropylene	Chiba, Japan	350	
	Kashima, Japan	500	
Korea Petrochemical	Ulsan, South Korea	360	
	Onsan, South Korea	470	
LyondellBasell	Bayport, TX, USA	723	
	Berre (FBL Area), France	350	
	Brindisi, Italy	445	
	Knapsack, Germany	250	
	Lake Charles, LA, USA	460	
	Sarina, Canada	360	
	Tarragona, Spain	340	
	Wesseling, Germany	260	
	Plock, Poland	400	
Malaysia Polypropylene	Gebeng, Malaysia	480	
Mehr Petrochemiya	SPSEZ, Iran		450 ⁽¹⁾
National Polypropylene	Al Jubail, Saudi Arabia	400	1000 ⁽²⁾
NEO Group	Klaipeda, Lithuania	310	
Ningbo Heyuan Chemical	Zhejiang, China	400	
Ningxia Baofeng Energy	Ningxia Hui, China	2500	3000 ⁽²⁾
ONGC Petro additions Limited	Dahej, India	340	
Panjin Ethylene Industry	Panjin, China	300	
Pequiven	El Tabazo, Venezuela	144	485 ⁽²⁾
Polychim	Garyville, LA, USA	470	
PolyMirae	Yeochun, South Korea	700	
Polyolefin	Jurong Island, Singapore	750	
Prime Polymer	Osaka, Japan	400	
	Tokuyama, Japan	250	
	Sakai, Japan	800	
Pucheng Clean Energy Chemical	Shaanxi, China		400 ⁽¹⁾
Qatar Petroleum-Total Petrochemical jv	Mesaieed, Qatar		759 ⁽¹⁾
Reliance	Hazira, India	400	900 ⁽²⁾
	Jamnagar, India	900	1800 ⁽²⁾
Repsol	Tarragona, Spain	390	
SABIC	Geleen, Netherlands	600	
	Gelsenkirchen, Germany	500	
Samsung-Total Petrochemical	Daesan, South Korea	550	
Sasol	Secunda, South Africa	520	
Saudi Kayan Petrochemical	Al Jubail, Saudi Arabia	350	
Saudi Polymers	Al Jubail, Saudi Arabia	440	
Shaanxi Yanchang Petroleum	Shaanxi, China		600 ⁽¹⁾
Shaoxing Sanyuan	Zhejiang, China	500	
Shell-CNOOC jv	Daya Bay, China	280	

Shenhua Group	Baotou, China	520	
Shenhua Ningxia Coal	Ningxia, China	500	1500 ⁽²⁾
Siam Cement Group (Thai Polypropylene)	Rayong, Thailand	720	
Sichuan Petrochemical	Sichuan, China		450 ⁽¹⁾
Sinopec (Tianjin Petrochemical)-SABIC jv	Tianjin, China	505	
Sinopec (Maoming Petrochemical)	Maoming, China	470	
(Wuhan Petrochemical)	Hubei, China	400	
(Yangzi Petrochemical)	Nanjing, China	400	
(Yanshan Petrochemical)	Beijing (Yanshan), China	450	
(Zhenhai Petrochemical)	Ningbo, China	300	
(Zhenhai Petrochemical)	Zhenhai, China	250	
Slovnaft	Bratislava, Slovakia	255	
Sumitomo Chemical	Chiba, Japan	300	
Suzano	Duque de Caxais, Brazil	360	
	Maua, Brazil	450	
TAIF Group	Budennovsk, Russia	210	610 ⁽²⁾
Thai Petrochemical Industry	Rayong, Thailand	475	
Titan	Pasir Gudang, Malaysia	480	
Total Petrochemicals	La Porte, TX, USA	1227	
	Feluy, Belgium	900	
TriPolyta (Polytama Propindo)	Merak, Indonesia	380	
Unipetrol	Litvinov, Czech Republic	275	
Yan'an Refining and Chemical	Yan'an, China	300	
YANPET	Yanbu, Saudi Arabia	960	
YANSAB	Yanbu, Saudi Arabia	400	
Zhongsha Petrochemical	Quanzhou, China	450	

(*) Equal or over 250 kt, there are 201 polypropylene plants in ChemPlan database; (**); (**) New or expansions: (1) New plants;

(2) Expansions-both 2014-2017

GLOBAL MARKET SHARES FOR POLYPROPYLENE IN 2013



For more information about plant, market and site-specific/technology-specific investment and production cost data for PP and some 1000 more chemicals, please send your inquiries to trantech@chemplan.biz.

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