



Polypropylene

Resistance of Polypropylene to Chemicals

Technical Information
Testing: ISO norm



About Basell

Basell develops, produces and markets polypropylene, polyethylene, advanced polyolefin materials and polyolefin catalysts, and also develops and licenses polyolefin processes.

Formed in October 2000, Basell is owned equally by BASF and Shell. Basell and its joint ventures serve customers in more than 120 countries with materials produced in 18 countries. The company's network of joint ventures expands Basell's technology and market base and enables the company to follow key customers as they expand and globalise their operations.

With research and development centres in Europe, North America and the Asia-Pacific region, Basell is continuing and expanding a technological heritage that dates back to the start of the polyolefins industry. The company is committed to continuously extending the property profile of its polyolefins portfolio and to developing with its customers a shared agenda for bringing new products to market as quickly as possible.

Basell is committed to strong Health, Safety and Environmental (HSE) performance. The company's products are used in countless consumer and industrial goods from food and drink packaging to car components, and from household products to underground piping.

Basell's corporate centre is located in Hoofddorp, The Netherlands, near Amsterdam. The company has regional offices in Brussels, Belgium; Mainz, Germany; Wilmington, Delaware, USA; Sao Paulo, Brazil, and Hong Kong, as well as sales offices in the major markets around the world.



Resistance of Polypropylene to Chemicals

The resistance of polypropylene produced by Basell – sold under the trademarks *Moplen*, *Clyrell*, *Adstif* and *Metocene* – to chemicals is governed by its non-polar character.

Polypropylene is resistant to many polar liquids such as alcohols, organic acids, esters, and ketones. However, it is swollen by aliphatic and aromatic hydrocarbons and by halogenated hydrocarbons. The less crystalline the polymer, the greater the swelling. Swelling also causes a drop in mechanical strength. However, after the liquids that cause the swelling have evaporated, polypropylene regains its original properties.

Polypropylene is resistant to aqueous solutions of inorganic salts and to almost all inorganic acids and alkalis – even at high concentrations and temperatures above 60°C. However, strong oxidizing agents (e.g. chloro-sulfonic acid, fuming sulfuric acid, concentrated nitric acid and halogens) will attack polypropylene at room temperature. For medical applications requiring sterilisation with steam, ethylene oxide or gamma ray, Basell has developed special grades.

If you are interested in such grades, please contact your local Basell representative.

To date, chemicals have never been observed to cause environmental stress-cracking in polypropylene.

Polypropylene is partially permeable to gases, low-boiling aliphatic and aromatic hydrocarbons, and halogenated hydrocarbons.

In the following tables are the results of numerous tests according to ISO 175. The results are based on 1 mm thick pressed samples stored for 30 days, under no load conditions, in the substance under investigation. Also taken into account where available, is practical knowledge for longer term contact with these substances. The assessment of chemical resistance is based on change in weight after 30 days storage in the substance under test as well as a tensile test on the swollen sample according to ISO 527-2.

The suitability of contact to chemicals can depend on the shape and requirements of the product.

In many cases, it is imperative that practical tests are carried out to confirm suitability.

In the tables abbreviations are used as follows:

Cold sat. = cold saturated solution
 b = measured value at boiling point of test substance
 a = aqueous solution

The resistance tables are marked with following symbols:

+ = Resistant
 Any swelling is slight with only minor changes to tensile yield stress.
 ± = Limited resistance
 Noticeable swelling and tensile yield stress is noticeably reduced. Tests should be carried out to confirm suitability in critical cases.
 – = Not resistant
 Swelling is severe and tensile yield stress is severely reduced.

Missing symbol indicates that no test was carried out under the condition stated.

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Chemicals						
Acetic acid	a. 50	+	+		+	
Acetic acid	a. 10	+	+		+	+
Acetic acid (glacial)	100	+	±	–	+	
Acetic anhydride	100	+			+	
Acetone	100	+	+	(b)	+	
Acrylonitrile	100	+			+	
Allyl alcohol	a. 96	+	+		+	
Aluminium salts	a. all	+	+	+	+	+
Alums (all types)	a. all	+	+		+	+
Ammonia	a. 30	+	+		+	
Ammonia	a. 10	+	+		+	+
Ammonia, gaseous	100	+	+			
Ammonia, liquid	100	+				
Ammonium acetate	a. all	+	+	+	+	+
Ammonium carbonate	a. all	+	+	+	+	+
Ammonium chloride	a. all	+	+	+	+	+
Ammonium nitrate	a. all	+	+	+	+	+
Ammonium phosphate	a. all	+	+	+	+	+
Ammonium sulphate	a. all	+	+	+	+	+
Amyl acetate	100	±	–		±	
Amyl alcohol	100	+	+		+	
Aniline	100	+	+		+	
Anisole	100	±			±	
Barium salts	a. all	+	+	+	+	+
Benzaldehyde	100	+			+	
Benzaldehyde	a. cold sat.	+			+	
Benzene	100	±	–		–	
Benzoic acid	100	+	+		+	
Benzoic acid	a. cold sat.	+	+	+	+	+
Benzyl alcohol	100	+	±		+	
Borax	a. cold sat.	+	+		+	+
Boric acid	100	+	+		+	
Boric acid	a. cold sat.	+	+		+	+
Bromine vapour	high	–			–	
Bromine vapour	Low	±	–		–	
Bromine water	cold sat.	–			–	
Bromine, liquid	100	–			–	

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Chemicals						
Butane, gaseous	100	+	+			
Butane, liquid	100	+				
1,4-Butane diol	100	+	+		+	
Butane diol	100	+	+		+	
Butyl acetate	100	±	–		±	
n-Butyl alcohol (n-Butanol)	100	+			+	
Butyl glycol	100	+			+	
Calcium carbonate	a. cold sat.	+	+	+	+	+
Calcium chloride	a. cold sat.	+	+	+	+	+
Calcium hypochlorite	a. all	+	+		+	
Calcium nitrate	a. cold sat.	+	+		+	+
Carbon disulphide	100	±			±	
Carbon tetrachloride	100	–			–	
Chlorine water	cold sat.	±	–		–	
Chlorine, gas, dry	100	–			–	
Chlorine, gas, moist	10	±	–		–	
Chlorine, liquid	100	–			–	
Chloroacetic acid	100	+			±	
Chlorobenzene	100	±	–		–	
Chloroform	100	±	–		–	
Chlorosulphonic acid	100	–			–	
Chromium salts (dibasic, tri basic)	a. cold. sat.	+	+		+	+
Chromium trioxide (Chromic acid)	a. cold. sat.	±	–			
Chromium trioxide	a. 20	+	±		+	
Citric acid	a. cold sat.	+	+	+	+	+
Copper salts	a. cold sat.	+	+		+	
Cresols	100	+	±		+	
Cresols	a. cold sat.	+			+	
Cyclohexane	100	±			–	
Cyclohexanol	100	+	±		+	
Cyclohexanone	100	+	–		±	
Decahydronaphthaline	100	±	–		–	
Diethylether	100	±			±	
Diisopropylether	100	±	–		±	
Dimethylformamide	100	+			+	
1,4-Dioxan	100	±	±	–	±	

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Chemicals						
Ethyl acetate	100	±	±		±	
Ethyl alcohol	100	+			+	
Ethyl alcohol	a. 96	+	+		+	
Ethyl alcohol	a. 50	+	+		+	
Ethyl alcohol	a. 10	+	+		+	
Ethyl chloride	100	– (b)			– (b)	
Ethylbenzene	100	±	–		–	
Ethylene chloride	100	±			±	
2-Ethylhexanol	100	+			+	
Formaldehyde	a. 40	+	+		+	
Formaldehyde	a. 30	+	+		+	
Formaldehyde	a. 10	+	+		+	
Formic acid	a. 98	+	±		+	
Formic acid	a. 85	+	±		+	
Formic acid	a. 50	+	±		+	
Formic acid	a. 10	+	±		+	
Fructose	a. cold sat.	+	+	+	+	+
Glucose	a. cold sat.	+	+	+	+	+
Glycerine	100	+	+	+	+	
Glycerine	a. all	+	+	+	+	
Glycol	100	+	+	+	+	
Glycol	a. all	+	+	+	+	
n-Heptane	100	±	±		–	
n-Hexane	100	±	±		–	
Hydrobromic acid	50	+			+	
Hydrochloric acid	36	+	+		+	
Hydrochloric acid	10	+	+		+	+
Hydrofluoric acid	40	+	+		+	
Hydrogen chloride, gas	all	+	+		+	
Hydrogen peroxide	30	+	±		±	
Hydrogen peroxide	3	+	+		+	
Hydrogen sulphide	a. low	+	+		+	
Iron salt	a. cold sat.	+	+	+	+	+
Isooctane	100	±	±		–	

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Chemicals						
Isopropylalcohol	100	+	+		+	
Lactic acid	a. 90	+	+		+	
Lactic acid	a. 50	+	+		+	
Lactic acid	a. 10	+	+	+	+	+
Magnesium salts	a. cold sat.	+	+	+	+	+
Menthol	100	+			+	
Mercury	100	+	+		+	
Mercury salts	a. cold sat.	+	+		+	+
Methyl acetate	100	+	+	(b)	±	
Methyl alcohol	a. 50	+	+		+	
Methyl alcohol (methanol)	100	+	+	(b)	+	
Methyl ethyl ketone	100	+	±		±	
Methylene chloride	100	±			-	
Morpholine	100	+	+		+	
Naphthalene	100	+				
Nickel salts	a. cold sat.	+	+		+	+
Nitric acid	68	-	-		-	
Nitric acid	50	±	-		-	
Nitric acid	25	+	±		±	
Nitric acid	10	+	+		+	
Nitrobenzene	100	+	±		+	
Oleic acid	100	+			+	
Oxalic acid	a. cold sat.	+	±		+	
Ozone (< 0.5 ppm)		+	±			
Perchloroethylene (see tetrachloroethylene)						
Phenol	100	+	+		+	
Phenol	a. cold sat.	+	+		+	
Phosphoric acid	85	+	+		+	
Phosphoric acid	50	+	+		+	
Phosphoric acid	10	+	+	+	+	+
Phosphorus oxychloride	100	+	±			
Phosphorus pentoxide	100	+			+	
Phosphorus trichloride	100	+			±	

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Chemicals						
Phthalic acid	a. 50	+	+		+	
Potassium carbonate (potash)	a. cold sat.	+	+		+	+
Potassium chlorate	a. cold sat.	+	+		+	
Potassium chloride	a. cold sat.	+	+	+	+	+
Potassium dichromate	a. cold sat.	+	+	+	+	
Potassium hydroxide solution	50	+	+		+	+
Potassium hydroxide solution	25	+	+		+	+
Potassium hydroxide solution	10	+	+		+	+
Potassium iodide	a. cold sat.	+	+		+	+
Potassium nitrate	a. cold sat.	+	+		+	+
Potassium permanganate	a. cold sat.	+	+		+	
Potassium persulphate	a. cold sat.	+			+	
Potassium sulphate	a. cold sat.	+	+		+	+
Propane, gas	100	+	+			
Propane, liquid	100	+				
Propionic acid	a. 50	+	+		+	
Propylene glycol	100	+	+		+	
Pyridine	100	±	±		±	
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Silver salt	a. cold sat.	+	+		+	+
Sodium acetate	a. cold sat.	+	+	+	+	+
Sodium bisulphite	a. cold sat.	+	+		+	
Sodium carbonate	a. cold sat.	+	+		+	+
Sodium carbonate	a. 10	+	+	+	+	+
Sodium chlorate	a. 25	+	+		+	
Sodium chloride (common salt)	a. cold sat.	+	+	+	+	+
Sodium chlorite	a. 5	+			+	
Sodium hydrogen carbonate (sodium bicarbonate)	a. cold sat.	+	+	+	+	+
Sodium hydroxide (caustic soda)	100	+	+		+	
Sodium hydroxide solution	50	+	+		+	+
Sodium hydroxide solution	25	+	+		+	+
Sodium hydroxide solution	10	+	+	+	+	+
Sodium hypochlorite	a. 13	±	±			
Sodium nitrate	a. cold sat.	+	+		+	+
Sodium nitrite	a. cold sat.	+			+	
Sodium perborate	a. cold sat.	+	+	+	+	+
Sodium phosphate	a. cold sat.	+	+	+	+	+

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Chemicals						
Sodium sulphate	a. cold sat.	+	+	+	+	+
Sodium sulphide	a. cold sat.	+	+		+	+
Sodium sulphite	a. cold sat.	+	+		+	+
Sodium thiosulphate (fixing salt)	a. cold sat.	+	+		+	+
Stearic acid	100	+			+	
Succinic acid	a. cold sat.	+	+		+	+
Sulphur	100	+	+	+	+	
Sulphur dioxide	all	+	+		+	
Sulphuric acid	98	±	–		±	
Sulphuric acid	85	+	±		±	
Sulphuric acid	50	+	+		+	
Sulphuric acid	10	+	+	+	+	+
Tartaric acids	a. cold sat.	+	+		+	+
Tetrachloroethane	100	±	–		–	
Tetrachloroethylene (perchloroethylene)	100	±	–		–	
Tetrahydrofurane	100	±	–		–	
Tetrahydronaphthaline	100	±	–		–	
Thiophene	100	±	–		±	
Tin(II) chloride	a. cold sat.	+	+		+	+
Toluene	100	±	–		–	
Trichloroethylene	100	±	–		–	
Urea	a. cold sat.	+	+		+	+
Water	100	+	+	+	+	+
Xylene	100	±	–		–	
Zinc salts	a. cold sat.	+	+		+	+

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Industrial commodities, cosmetics						
Acronal® dispersion		+				+
Anti-freeze		+	+	+		+
Asphalt ¹		+	±			+
Battery acid		+	+			+
Beeswax		+	±			+
Bleaching solution (12.5% active chlorine)		+	±			
Bone oil		+	+			+
Brake fluid ¹		+	+			
Chlorinated lime (aqueous suspension)		+	+			
Chrome baths ¹ (ind.)		+	+			
Chromic-sulphuric acid mixture		-				-
Detergent	a. commercial	+				+
	a. ready for use	+	+	+		+
Dextrin	a. cold sat.	+				+
Diesel oil		±				
Engine oil ¹		+	±	-		+
Fatty alcohol sulphonate		+				+
Fir-needle oil		+	+			
Fixing salt	a. all	+	+			+
Floor polish ¹		+	±			
Fuel oils ¹		±	±			-
Furniture polish ¹		+	±	-		
Ink ¹		+	+			+
Kerosene		±	±			-
Lanolin® (wool fat)		+	±			+
Linseed oil		+	+			+
Lysol®		+	±			+

¹ Resistance is dependent on composition

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Industrial commodities, cosmetics						
Mineral oils (free from aromatic hydrocarbons) ¹		+	±	-		
Nail varnish remover ¹		+	±			
Nail varnish ¹		+	±			
Oleum	all	-				-
Paraffin		+	+	-		+
Paraffin oil		+	±	-		+
Perfume		+				+
Petroleum		±	±			-
Petroleum ether		±	±			-
Photographic developer	a. commercial	+	+			+
	a. ready for use	+	+			+
Pine-needle oil		+	+			
Raw gasoline		±	-			-
Sagrotan®		+	±			
Shampoo ¹		+	+			+
Shoe polish ¹		+	±			
Silicon oils ¹		+	+	+		+
Soap (bar)		+	+			+
Soap solution		+	+			+
Soft soap		+	+			+
Softener						
- Dibutylphthalate		+				+
- Diisononylphthalate		+				+
- Dioctyladipate		+				+
- Dioctylphthalate		+				+
- Tricresylphosphate		+				
- Trioctylphosphate		+				
Standard grade petrol		±	-			-
Super grade petrol		±	-			-

¹ Resistance is dependent on composition

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Industrial commodities, cosmetics						
Tar ¹		+	±			
Terpentine		±	-			-
Toothpastes		+	+			+
Transformer oil ¹		+	±			
Vaseline		+	±			+
Washing-up liquid	a. commercial	+				+
	a. ready for use	+	+	+		+
Water glass		+	+			+
White spirit		±	-			-
Foodstuffs						
Apple juice		+	+			+
Apple purée		+	+	+		+
Beef dripping		+	+			+
Beer		+				+
Bitter almond oil		+				+
Blancmange		+	+	+		+
Brandy		+				+
Butter		+	+			+
Buttermilk		+				+
Cake		+	+	+		+
Cheese		+				+
Cinnamon		+				+
Clove oil		+	±			
Cloves (spice)		+				+
Cocoa (prepared)		+	+	+		+
Cocoa powder		+				+
Coconut oil		+	+			+
Coffee (beans and ground)		+				+
Coffee (prepared)		+	+	+		+
Cola drink		+				+
Corn oil		+	±			+
Cream, whipped cream		+				+

¹ Resistance is dependent on composition

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Foodstuffs						
Curds		+			+	
Edible oil, vegetable		+	±		+	
Edible oil, animal		+	±		+	
Fish, pickled		+	+	+	+	
Flour		+			+	
Fruit juices		+	+		+	+
Fruit salad		+			+	
Gelatine	a. all	+	+		+	
Gin		+				
Grapefruit juice		+	+		+	+
Honey		+	+		+	+
Horseradish (prepared)		+			+	
Jam		+	+	+	+	
Jelly		+	+	+	+	+
Kippers		+			+	
Lemon flavouring		+				
Lemon juice		+	+		+	+
Lemon oil		+				
Lemon peel		+				
Lemonades		+			+	
Liqueurs	all	+			+	
Liver oil		+			+	
Margarine		+	+		+	
Mayonnaise		+			+	
Milk		+	+	+	+	+
Milk products		+	+	+	+	+
Mineral water		+	+	+	+	+
Mustard		+			+	

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Foodstuffs						
Olive oil		+	+		+	
Orange juice		+	+		+	+
Orange peel		+				
Orange oil (sweet)		+				
Palm oil		+	±		+	
Paprika (spice)		+			+	
Peanut oil		+	+	±	+	
Pectin	a. cold sat.	+	+		+	
Pepper		+				
Peppermint oil		+				
Pineapple juice		+	+		+	+
Pork dripping		+	+	±	+	
Potato (mashed)		+	+		+	+
Potato salad		+			+	
Rum		+	+		+	
Rum flavouring		+				
Salt (dry)		+	+	+	+	
Salt water	all	+	+	+	+	+
Sauerkraut (prepared)		+	+	+	+	+
Sausage		+	+		+	
Soda water		+			+	
Soya oil		+	±		+	
Starch, starch solution	a. all	+	+		+	
Sugar beet syrup		+	+	+	+	
Sugar solution	a. all	+	+	+	+	
Sugar, dry		+	+	+	+	
Tea (prepared)		+	+	+	+	+
Tea leaves		+	+		+	
Tomato juice		+	+		+	+
Tomato ketchup		+	+		+	
Vanilla		+			+	
Vegetables		+	+	+	+	+
Vinegar	commercial	+	+		+	+

Substance	Concentration by mass (%)	Homopolymer Heterophasic Copolymer			Random Copolymer	
		20°C	60°C	100°C	20°C	60°C
Foodstuffs						
Whisky		+			+	
Wine, mulled wine		+	+		+	+
Yeast	a. all	+			+	

Note:

The information submitted in this publication is based on our current knowledge and experience. In view of the many factors that may affect processing and application, this data do not relieve processors of the responsibility of carrying out their own tests and experiments; neither does it imply any legally binding assurance of certain properties or of suitability for a specific purpose. It is the responsibility of those to whom we supply our products to ensure that any proprietary rights and existing laws and legislation are observed.

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Corporate Centre

Basell N.V.
Hoeksteen 66
2132 MS Hoofddorp
The Netherlands
Tel: +31 20 4468 644
Fax: +31 20 4468 666

Europe Regional Offices

Basell Polyolefins Company N.V.
Woluwe Garden
Woluwedael 24
1932 Zaventem (Brussels)
Belgium
Tel: +32 2 715 80 00
Fax: +32 2 715 80 50

Basell Polyolefine GmbH
Rheinstrasse 4G
D-55116 Mainz
Germany
Tel: +49 6131 207 0
Fax: +49 6131 207 555

North America Regional Offices

Basell North America Inc.
Three Little Falls Centre
2801 Centerville Road
Wilmington, Delaware 19808-1652
USA
Tel: +1 302 996 6000
Fax: +1 302 996 6051

South and Central America Regional Offices

Basell Brasil Ltd.
Estrada Samuel Alzemberg, 1701
San Bernado do Campo
09851-550
Sao Paulo,
Brazil
Tel: +55 11 4343 3460
Fax: +55 11 4343 3464

Asia-Pacific Regional Offices

Basell China Ltd.
22/F Hennessey Centre
500 Hennessey Road
Causeway Bay
Hong Kong
China
Tel: +852 2577 3855
Fax: +852 2895 5431

Australia Sales Office

Basell Australia Pty. Ltd.
Level 2, 191 Toorak Road
South Yarra, VIC 3141
Melbourne,
Australia
Tel: +61 3 9829 9455
Fax: +61 3 9829 9431

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