



**TPX**<sup>TM</sup>  
Transparent Polymer **X**



Creating a Leading Edge  
by Unique Combination.

# TPXX™

Transparency

Heat Resistance

Releasability

High  
Insulation  
Properties

Chemical /  
Steam  
Resistance

Transparency

Heat  
Resistance

High  
Releasability  
(Surface Tension:  
24mN/m)

Gas  
Permeability

Lower  
Density

Halogen Free  
Food  
Sanitation

01

## Heat Resistance

TPX™ has a high melting point in the range from 220°C to 240°C and a high vicat softening temperature. Hence, it can be used for high temperature application. However, as heat distortion temperature of TPX™ is almost the same as that of polypropylene, the application under high-stress environment needs to be carefully considered.

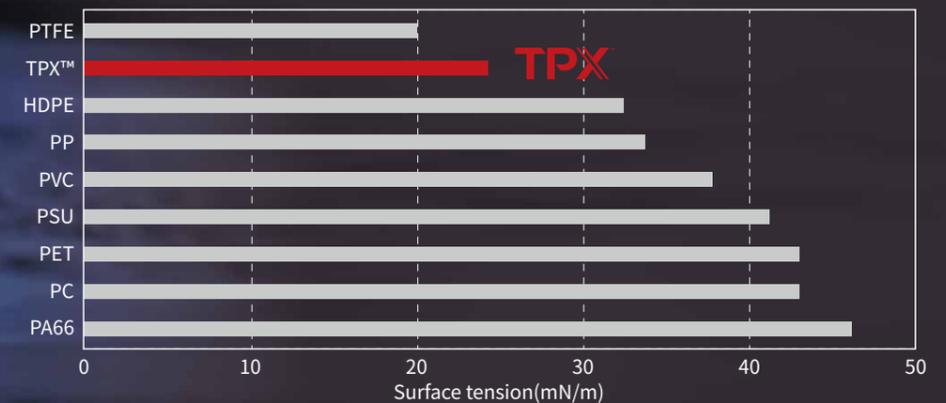
	Unit	TPX™ (RT18)	HDPE	PC	Homo-PP	PA6
<b>Melting Point</b> <small>*Amorphous polymer:tg</small>	°C	<b>232</b>	132	150	168	225
<b>Vicat Softening Temperature</b>	°C	<b>167</b>	128	154	157	195
<b>HDT (0.45MPa)</b>	°C	<b>86</b>	75	142	100	182

\*All results were measured by ISO306.

02

## Releasability and Non-compatibility

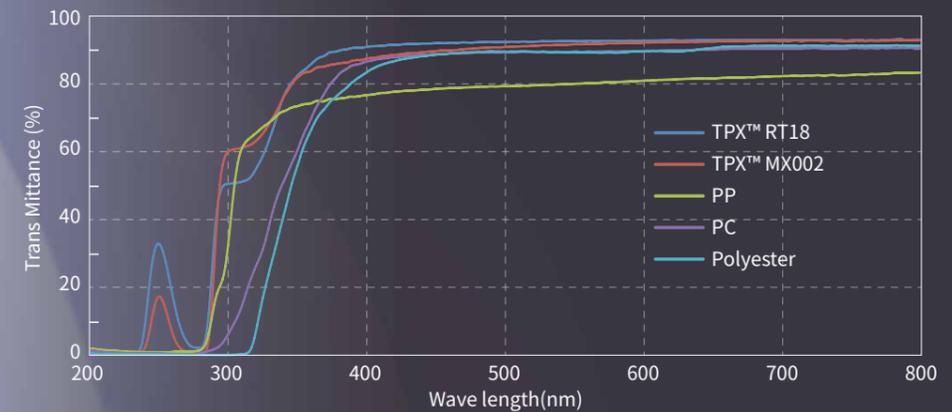
The surface tension of TPX™ (24mN/m) is very low and this value is the second lowest as compared to fluorine polymers. Hereby, TPX™ shows excellent releasability against various materials in hardening process of thermosetting resins (urethane, epoxy etc.) Furthermore, since TPX™ shows incompatibility against thermoplastic resins (PET, PP etc.), it is used to create a porous structure in PET or membranes.



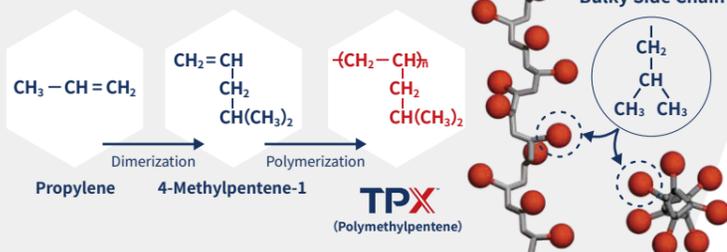
03

## Transparency

Although TPX™ is a crystalline polymer, it exhibits excellent transparency (Haze < 5%) and light transmittance. In particular TPX™ is used for optical analysis cells because of the higher UV transmittance as compared to glass and other transparent polymers.



## Crystal Structure of TPX™



04

### Chemical Resistance

Because of its stable C-C bonds, TPX™ has better chemical resistance as compared to polycarbonate and acrylic polymer. TPX™ basically shows excellent chemical resistance particularly against acids, alkalis and alcohol. For this reason, TPX™ is used in various applications which require chemical resistance, such as cosmetic container caps and tubes, experimental apparatus and analytical cells.

05

### Gas Permeability

TPX™ has a characteristic of excellent gas permeability derived from its molecular structure. Hence, TPX™ is widely used for gas permeative applications such as gas separation membranes.

06

### Low Dielectric Property

Since TPX™ has a non-polar structure; its dielectric property is almost the same as fluorine polymers. It should be noted that dielectric property of TPX™ is hardly affected by frequency and TPX™ can be injection-molded unlike PTFE. TPX™ shows stable dielectric property in the wide range of frequency.

07

### Low Density

The density of TPX™ is the lowest (833 kg/m<sup>3</sup>) among thermoplastic polymers, and its specific volume is larger than that of other transparent polymers. For this reason, it is possible to reduce the weight of injection-molded articles by using TPX™ or also TPX™ compounds.

08

### Steam Resistance

TPX™ shows a very low water absorbance and therefore the dimension of a TPX™ product is hardly affected by water absorbance. Furthermore, since TPX™ does not hydrolyze in boiling water, it can be used for experimental apparatus and animal cages which require the steam sterilization.

09

### Food Sanitation

Hygienic approved TPX™ grades (JPN standards, FDA and EU regulations) are also available. And with its excellent heat resistance property, TPX™ is often used for food wraps and microwave oven table ware.

10

### Low Refractive Index

The refractive index of TPX™ is 1.463n<sub>D</sub>, lower than fluorine polymers.



## 01 Food Containers

Heat Resistance Releasability Transparency

TPX™ has good releasability following fluorine resin. It prevents the stains, colors and smells of food from remaining in a container. Further, it has excellent heat resistance and can withstand cooking oily food in a microwave oven.

[Recommended Grades: RT31/RT31XB/RT18/RT18XB]



## 02 Release Film for FPC

Heat Resistance Releasability Uneven Followability

While boasting high heat resistance, TPX™ also features low heat distortion temperature, which enables it to follow minute protrusions and recesses of FPC substrate surface. This stops adhesive leaking to the circuit section during the pressing process. TPX™ is also more releasable than other materials, simplifying releasing tasks.

[Recommended Grades: RT18/MX002/MX004]



## 03 Mandrel / Sheath

Heat Resistance Releasability Dimensional Stability Repeat Use

TPX™ features excellent heat resistance and enables high temperature vulcanization. TPX™ mandrels ensure high precision of the hose's inner diameter while TPX™ sheaths enable mirror finishing of the hose's exterior. Both mandrels and sheaths can be used repeatedly, enabling manufacturing costs to be lowered.

[Recommended Grades: D845/MX002/MX004/DX560M]



## 04 Release Paper for Synthetic Leather

Heat Resistance Releasability

Because of its high heat resistance and pattern transferability, TPX™ is used widely for release paper for synthetic leather. It can also be used more repeatedly than other materials, helping to reduce the process cost.

[Recommended Grades: DX231/310/MX002]



## 05 Experimental Apparatuses

Transparency Chemical Resistance

Because of its stable C-C bonds, TPX™ has better chemical resistance compared with PC/PMMA materials. TPX™ basically shows excellent chemical resistance, particularly against acids, alkalis, and alcohol. For this reason, TPX™ is also used for experimental apparatuses.

[Recommended Grades: RT18/RT31/MX0020 etc.]



## 06 Hollow Fiber

Gas Permeability Steam Resistance

TPX™ is characterized by its excellent gas permeability, which derives from its molecular structure. This gives TPX™ broad gas permeative applications, such as hollow fiber for artificial lungs and gas separation membranes for sewage treatment facilities.



## 07 Resin Modification

Releasability Heat Resistance

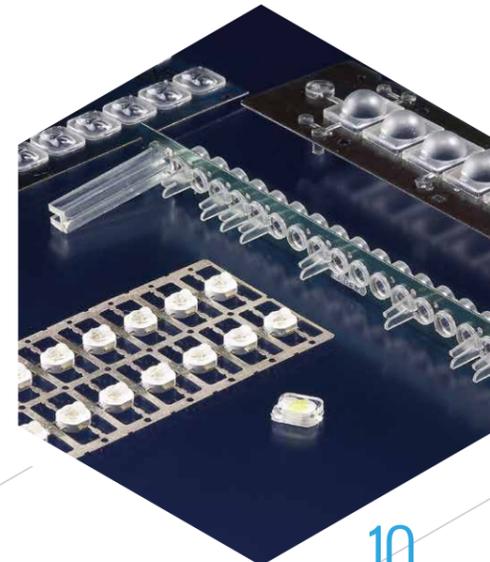
As a resin modifier, TPX™ is mainly used for the purpose of improving heat resistance. Further, we have some achievements even on the production of synthetic paper and etc., making use of its incompatibility.



## 08 Heat-Resistant Wraps

Heat Resistance Transparency

Wraps made by using TPX™ remain unmelted at higher temperatures compared to conventional wraps (PVDC and PE wraps). Hence, they can be used safely for cooking or reheating food in a microwave oven.



## 09 LED Mold

Heat Resistance Releasability

Harnessing its heat resistance and releasability, TPX™ is used for the release molds of LED. Moreover, these molds can be used repeatedly, helping to reduce manufacturing cost.

[Recommended Grades: RT18]



## 10 Animal Cage

Transparency Steam Resistance Light Weight

Taking advantage of its heat resistance, transparency, and light weight, TPX™ is also used for animal cages. TPX™ has also found medical-related applications, signifying that the cages have a minimal impact on living things.

[Recommended Grades: MX004/MX004XB]

Physical Properties				Type	High-Modulus					Mid-Modulus		Low Modulus				Opaque					
				Grade	RT18 (RT18XB)	RT31 (RT31XB)	DX845	DX820	DX231	MX004	DX324	MX002	MX002O	MX001	DX310	DX820M	DX560M	MLL411	MBZ230(A)		
List	Methodology	Measured Condition / Sample Condition	Unit																		
Basic Properties	Density	MCI Method	Density Gradient Method / Pellets	kg/m <sup>3</sup>	833	833	833	832	832	833	833	834	834	834	834	840	856	834	1100		
	MFR	MCI Method	Applied Force= 5kgf, 260°C / Pellets	g/10 min	26	21	9	180	100	25	25	21	21	27	100	220	33	20	57		
	Melting Point	MCI Method	DSC Method / Pellets	°C	232	232	232	233	232	228	227	224	224	223	224	233	222	222	232		
	Water Absorption	ISO 62	Test Piece (1mm thick)	%	≤0.01	≤0.01	≤0.01	≤0.01	0.01	≤0.01	0.01	≤0.01	≤0.01	0.01	0.01	≤0.01	0.04	≤0.01	0.05		
Thermal Properties	Vicat Softening Temperature	ISO 306	Heat Speed: 50°C/hour Applied Load: 10N / Test Piece (4mm)	°C	167	167	167	171	179	161	162	151	149	147	144	140	87	141	169		
	Heat Distortion Temperature	ISO 75	Heat Speed: 120°C/hour Applied Stress: 0.45MPa / Test Piece (4mm)	°C	86	90	93	86	90	80	79	74	72	72	75	85	53	69	91		
	Coefficient of Linear Expansion	ISO 11359-1	Measured Range: -50°C~150°C Heat Speed 5°C/min / Test Piece (4mm)	°C <sup>-1</sup> (×10 <sup>-4</sup> )	1.31	— <sup>(※1)</sup>	1.72	1.03	— <sup>(※1)</sup>	1.44	— <sup>(※1)</sup>	1.53	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>		
Mechanical Properties	Yield Stress	ISO527	Cross Head Speed:5mm/min / Test Piece (4mm)	MPa	23	24	24	— <sup>(※2)</sup>	26	18	19	14	14	14	15	— <sup>(※2)</sup>	— <sup>(※2)</sup>	9	22		
			Cross Head Speed:50mm/min / Test Piece (4mm)	MPa	28	29	28	— <sup>(※2)</sup>	— <sup>(※2)</sup>	23	22	18	22	18	18	18	— <sup>(※2)</sup>	7	12	26	
	Fractured Stress		Cross Head Speed:5mm/min / Test Piece (4mm)	MPa	15	17	16	25	26	12	13	12	11	12	11	23	8	11	— <sup>(※2)</sup>		
			Cross Head Speed:50mm/min / Test Piece (4mm)	MPa	— <sup>(※2)</sup>	— <sup>(※2)</sup>	— <sup>(※2)</sup>	29	31	— <sup>(※2)</sup>	— <sup>(※2)</sup>	10	11	11	10	27	8	12	— <sup>(※2)</sup>		
	Fractured Strain		Cross Head Speed:5mm/min / Test Piece (4mm)	%	67	60	83	3	5	155	80	226	189	211	230	3	319	221	29		
			Cross Head Speed:50mm/min / Test Piece (4mm)	%	32	27	29	3	5	29	31	37	45	46	38	3	238	166	21		
	Tensile Modulus		ISO178	Cross Head Speed:2mm/min / Test Piece (4mm)	MPa	1350	1350	1480	1630	1490	770	690	430	510	490	520	1390	170	250	1720	
	Flexural Modulus			Cross Head Speed:1mm/min / Test Piece (4mm)	MPa	1530	1530	1520	1600	1550	810	750	530	540	530	550	1450	190	250	1910	
	Flexural Strength					MPa	37	40	40	43	41	26	24	18	19	19	20	38	6	10	41
	Izod Impact Strength		ISO180 (Part MCI Method)	Injection Molded Specimen (Machined Notch) / Test Piece (4mm)	kJ/m <sup>2</sup>	2	2	3	2	1	1	1	1	2	3	2	1	1	NB	NB	9 <sup>(※3)</sup>
Injection Molded Specimen (w/o Notch) / Test Piece (4mm)		kJ/m <sup>2</sup>		7	6	7	6	6	14	23 <sup>(※4)</sup>	NB	NB	NB	24 <sup>(※4)</sup>	7	NB	NB	30 <sup>(※4)</sup>			
Rockwell Hardness	ISO2039	HRR Scale	—	80	78	78	94	90	59	55	29	38	37	45	84	— <sup>(※2)</sup>	— <sup>(※2)</sup>	73			
Optical Properties	Haze	ISO14782	Light Source:D65 / Test Piece(2mm thick)	%	2.4	2.4	2.8	3.7	3.6	2.5	2.3	2.3	1.6	1.8	2.2	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>		
	Transmittance			%	93.0	93.0	93.0	92.0	92.0	93.0	92.0	92.0	92.0	92.0	92.0	92.0	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	
	Refractive Index	ISO489	Light Source:D Line/ Test Piece(2mm thick)	—	1.462	1.462	1.463	1.462	1.462	1.463	1.463	1.463	1.463	1.463	1.463	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>		
Electrical Properties	Volume Resistivity	IEC60093	Injection Molded Specimen (2mm thick)	Ω·cm	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>	>10 <sup>16</sup>							
	Dielectric Breakdown Voltage	IEC60243-1		kV/mm	30	29	28	31	31	30	28	29	29	28	30	31	30	29	27		
	Relative Dielectric Constant	IEC60250		1MHz / Injection Molded Specimen (2mm thick)	—	2.15	2.12	2.16	2.13	2.12	2.17	2.13	2.19	2.12	2.12	2.12	2.13	2.16	2.12	2.37	
Moldability	Spiral Flow	MCI Method	310°C~320°C, Mold Temperature73°C	cm	51	51	50	— <sup>(※1)</sup>	— <sup>(※1)</sup>	53	— <sup>(※1)</sup>	56	56	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	48		
	Mold Shrinkage	MCI Method	Injection Molded Specimen (2mm thick) MD	%	1.6	1.6	1.5	— <sup>(※1)</sup>	— <sup>(※1)</sup>	1.7	— <sup>(※1)</sup>	1.6	1.6	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	1.5		
			Injection Molded Specimen (2mm thick) TD	%	1.3	1.3	1.4	— <sup>(※1)</sup>	— <sup>(※1)</sup>	1.4	— <sup>(※1)</sup>	1.3	1.3	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	— <sup>(※1)</sup>	1.1		
Processing Method	Injection Molding			◎	◎	○	○	○	◎	◎	◎	◎	◎	◎		○		◎			
	Extrusion-Coating						◎	◎				○			◎						
	Extrusion-T-Die Casting		◎:Recommended	○	○	◎			◎	◎	◎	◎	◎	◎		○					
	Extrusion-Profile Type, Mandrel, Pipe		○:Applicable	○	○	○			◎	◎	◎	◎	○			◎	◎				
	Extrusion-Fiber Spinning			○	○	○	○	◎	○	○		○	○								
	Direct Blow Molding					○			○			○	○			○					

● Note1 : Figures shown here are representative values but not specified values. ● Note2: ~XB Types are Blue Tint Grade

※1 Not Measured ※2 Not Detective ※3 Partially Break ※4 Representative Values due to not specified hammer

## That's right! Let's ask Mitsui Chemicals!

### Our Global Network

**Mitsui Chemicals Europe GmbH**  
Oststrasse 34, 40211 Düsseldorf, Germany  
TEL: +49-211-173320 FAX: +49-211-17332-701

**Mitsui Chemicals (CHINA) Co., Ltd.**  
21F, Capital Square, 268 Hengtong Road, Jing'an District, Shanghai, 200070, P. R. China  
TEL: +86-21-5888-6336 FAX: +86-21-5888-6337

**Mitsui Chemicals India Pvt. Ltd.**  
3rd FLOOR, B-Wing, D3, District Centre, Saket, New Delhi 110017, India  
TEL: +91-11-3010 7400 FAX: +91-11-3010 7499

**Mitsui Chemicals Asia Pacific, Ltd.**  
3 HarbourFront Place #10-01 HarbourFront Tower 2 Singapore 099254, Singapore  
TEL: +65-6534-2611 FAX: +65-6535-5161

**Mitsui Chemicals Korea, Inc.**  
15F, Building-B, PINE AVENUE, 100, Eulji-ro, Jung-gu, Seoul, KOREA 04551  
TEL: +82-2-6031-0200 FAX: +82-2-6031-0220

**Mitsui Chemicals America, Inc.**  
800 Westchester Avenue, Suite S306 Rye Brook, NY 10573, U.S.A.  
TEL: +1-914-253-0777 FAX: +1-914-253-0790

**Taiwan Mitsui Chemicals, Inc.**  
7F-2, No. 4, Sec. 1, Jhongsiao W. Rd., Taipei, 10041, Taiwan  
TEL: +886-2-2361-7887 FAX: +886-2-2361-6776

### Our Japan Network

- **Head Office**  
Performance Polymers Div.  
Mobility Business Sector  
Shiodome City Center, 1-5-2 Higashi-Shimbashi, Minato-ku, Tokyo 105-7122  
TEL: +81-3-6253-3599 FAX: +81-3-6253-4221
- **Osaka Branch**  
Shinanobashi Mitsui Bldg. 8F, 11-7, Utsubohonmachi 1-chome, Nishi-ku, Osaka 550-0004  
TEL: +81-6-6446-3602 FAX: +81-6-6446-3638

#### [Precautions]

##### 1. General Precautions

The data indicated in this brochure are representative values which were obtained by our own testing methods. Furthermore, the written contents in this brochure are based on the current available information and data etc. Please be mentioned that we do not provide any warranty about the accuracy or suitability thereof for any particular applications.

- The detailed technical information will be given to you when you contact us.
- For the detailed safety information, please refer to Materials Safety Data Sheet of TPX™.
- Please pay attention to industrial property rights about applications listed in this brochure. Before using TPX™, please evaluate the practical applicability of TPX™ and make sure whether any problems will not be caused.
- Please avoid fire, direct sunshine, water wetting and any abrupt temperature change at the storage place of TPX™.
- Please avoid the outdoor usage of TPX™ for a long period of time as it may cause the color change or the quality deterioration.
- These precautions are given on the assumption that TPX™ would be used in a normal way. If TPX™ is used in any special way, please take additional safety measures.

##### 2. Use of TPX™ for Medical-related applications and Food contact applications

- Please contact us when you intend to use TPX™ in such applications.

### Examples of Molding and Measuring Equipment

To realize and shape the ideas of our customers into something real, we are providing various types of support in the field of Research & Development.



Sodegaura Center



Injection Molding Equipment



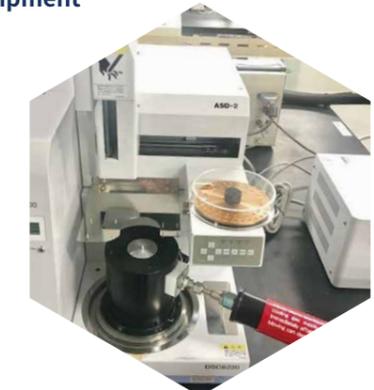
Mandrel Extrusion Equipment



Extrusion Laminating Equipment



MFR Measurement Equipment



DSC Measurement Equipment