

# TPX

## POLY - 4 - METHYLPENTENE -1 (PMP)

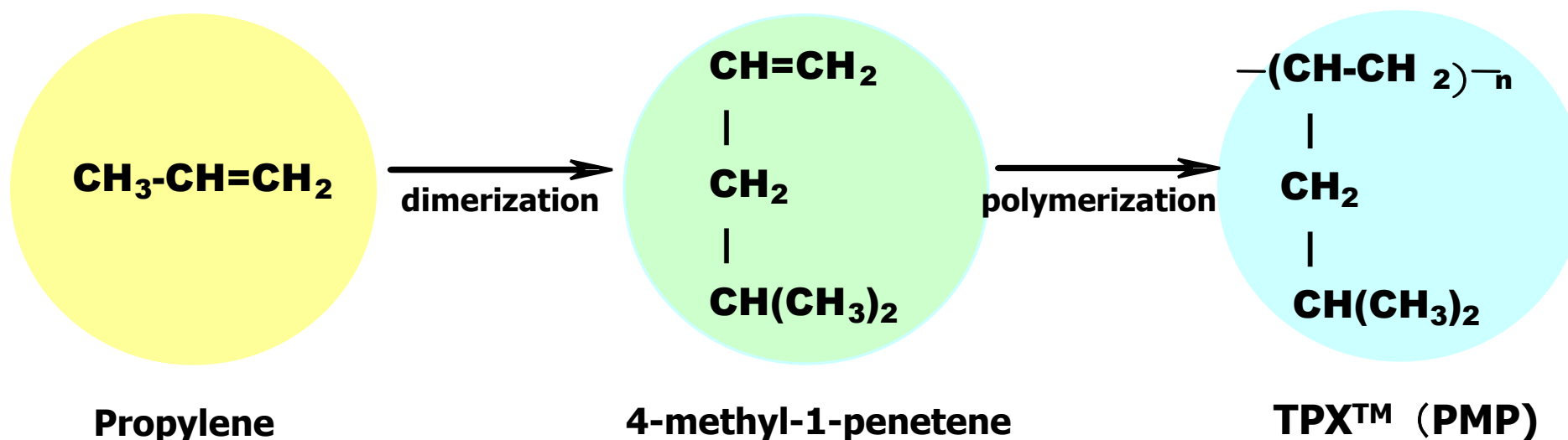
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**mitsui** CHEMICALS, INC.

# What is TPX™?

- TPX is a polyolefin made from 4-methylpentene-1 mainly .
- TPX has excellent heat resistance, peel ability, transparency, gas permeability etc.
- TPX is produced by special technology of molecular design and catalyst of Mitsui Chemicals, Inc.



# TPX™ Characteristics



Items	TPX Characteristics
Heat resistance	High melting temp : Melting point > 220°C
Density	Lowest among all plastics
Mechanical strength	Not so strong
Rigidity	Rigid at room temperature, Soft at high temp
Elongation	Brittle at room temperature, Flexible at high temp
Transparency	High transimission of visible and partially of UV-light
Color	No color
Chemical resistance	Strong against Acid/Alkaline, Weak against Gasoline/Oil
Water absorption	Very low
Electrical property	Low dielectric constant, High voltage resistance
Gas permeability	Very high
Affinity	Immiscible / Easy releasable

**Let's try to replace high price engineering plastics with TPX!**

# TPX versus PSF

## Advantage of TPX

- Low density
- Transparency
- Water absorption
- Electrical property
- Process ability
- Price

## Disadvantage of TPX

- Mechanical strength
- Toughness
- HDT

Items		Polymer		Polysulfone PSF
		TPX		
		RT18	MX004	
Density (g/cm <sup>3</sup> )		833	834	1370
Tm/(Tg) (°C)		237	227	(180)
Tensile property	Tensile strength (MPa)	20	34	70
	Elongation at break (%)	32	48	50~100
Flexural modulus (MPa)		1570	1000	2700
Izod(J/m)	with notch	40	40	60
HDT	0.45MPa	90	80	175
Optical property	Haze(%)	1	1	6.9
	Trans(%)	94	94	84
	Color	None	None	Light yellow
Chemical Resistance Acid/Alkali		Good/Good	Good/Good	Good/Good
Water absorption (%)		<0.01	<0.01	0.3
Electrical Property	Dielectric breakdown voltage (KV/mm)	65	65	17
	SpecificDielectric constant(1MHz)	2.1	2.1	3.1
	tan δ (1MHz)	0.0001	0.0001	0.005
Injection temp./Mold temp. (°C)		300/60	290/60	370/160
Price	(Euro/kg)	9	9	12
	(Euro/L)	7.5	7.5	14.4

## Applications substituted from PSF

- Sterilization case
- Hollow fiber (Membrane)



**Recommended grade : RT18, RT18XB, MX004**

# TPX versus PES

## Advantage of TPX

- Low density
- Transparency
- Water absorption
- Electrical property
- Process ability
- Price

## Disadvantage of TPX

- Heat Resistance
- Mechanical Strength
- Impact Strength
- HDT

Items		Polymer		Polyethersulfone PES
		TPX RT18	TPX MX004	
Density (kg/m <sup>3</sup> )		833	834	1370
Tm/(Tg) (°C)		237	227	(225)
Tensile property	Tensile strength (MPa)	20	34	84
	Elongation at break (%)	32	48	60
Flexural modulus (MPa)		1570	1000	2650
Izod(J/m)	with notch	40	40	80
HDT	0.45MPa	90	80	210
Optical property	Haze(%)	1	1	5
	Trans(%)	94	94	85
	Color	None	None	Light yellow
Chemical resistance	Acid/Alkali	Good/Good	Good/Good	Good/Good
Electrical Property	Dielectric breakdown voltage(KV/mm)	65	65	16
	SpecificDielectric constant(1MHz)	2.1	2.1	3.5
	tan δ (1MHz)	0.0001	0.0001	0.0035
Water absorption (%)		<0.01	<0.01	0.43
Injection temp./Mold temp.(°C)		300/60	290/60	350/120
Price (Euro/kg)		9	9	18
Price (Euro/L)		7.5	7.5	24.7

## Applications substituted from PES, PEI

- Electrical parts
- Membrane
- Sterilization case

**Recommended grade : RT18, MX004**

# TPX versus PA12, PA11

## Similar Features

- Heat Resistance
- Flexibility (DX560M)

## Advantage of TPX

- Water absorption
- Low density
- Chemical resistance
- Price

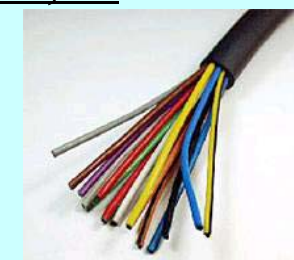
## Disadvantage of TPX

- Toughness
- HDT

Items		Polymer		Polyamide12 PA12
		TPX MX002	TPX DX560M	
Density (kg/m <sup>3</sup> )		835	855	1020
Tm/(Tg) (°C)		222	222	176
Tensile property	Tensile strength (MPa)	18	9	29
	Elongation at break (%)	60	140	300
Flexural modulus (MPa)		640	240	600
Izod(J/m)	with notch	40	NB	74
HDT	0.45MPa	75	62	131
Vicat softening temperature		151	91	150
Chemical resistance	Acid/Alkali	Good/Good	Good/Good	Poor/Good
Water absorption (%)		<0.01	<0.01	0.25
Price (Euro/kg)		9	9.7	15
Price (Euro/L)		7.5	8.2	15.3

## Applications substituted from PA12,11

- Chemical tube
- Cable-insulation



**Recommended grade : MX002, DX560M**

# TPX versus Fluorine polymers

## Similar Features

- Releaseability
- Heat Resistance
- Chemical Resistance
- Flexibility (>50°C)

## Advantage of TPX

- Electrical property
- Low density
- Halogen Free
- Price

## Disadvantage of TPX

- Toughness
- Durability
- Wear resistance
- Fireproof property

Items	Polymer	TPX		Fluorine polymer		
		MX004	MX002	PTFE	ETFE	PFA
Density (kg/m <sup>3</sup> )		834	835	2.2	2.15	1.74
Tm/(Tg) (°C)		227	222	327	310	260
Tensile property	Tensile strength (MPa)	34	18	25	39	46
	Elongation at break (%)	48	60	300	340	430
Flexural modulus (MPa)		1000	640	450	539	882
Izod(J/m)	with notch	40	40	NB	NB	NB
Chemical Resistance	Acid/Alkali	Good/Good	Good/Good	Good/Good	Good/Good	Good/Good
Electrical property	Dielectric breakdown voltage(KV/mm)	65	65	13	12	30
	SpecificDielectric constant(1MHz)	2.1	2.1	2.1	2.1	2.5
	tan δ (1MHz)	0.0001	0.0001	0.08	0.0003	0.08
Price	(Euro/kg)	9		20-30		
	(Euro/L)	7.5		40-60		

## Applications substituted from Fluorine polymers

- Tube
- Wire coating
- Industrial parts
- Electrical parts



**Recommended grade : MX004, MX002**

# TPX Current grades



## High rigidity

**RT18(XB)**

**RT31(XB)**

**DX350/DX231**

**DX820**

**DX845**

**Tm: >230°C, FM>1200MPa**

**Injection (XB): bluing**

**Injection / Less odor (XB): bluing**

**Coating**

**Coating and Additive / High flow**

**Extrusion / Low flow**

## Medium rigidity

**MX004**

**Tm: >225°C , FM=800~1200MPa**

**Injection / Extrusion**

## Low rigidity

**MX002**

**MX002O**

**DX310**

**Tm: >220°C , FM=600~800MPa**

**Injection / Extrusion**

**Extrusion for food application (except EU)**

**Coating**

## Flexible

**DX560M**

**FM<600MPa**

**Extrusion**



# TPX advantage and disadvantage



## ADVANTAGE

High melting temp  
Easy breakage  
Soft especially at high temp  
Stretchable in high temp  
Very low / Hydrophobic  
Strong against Acid/Alkaline  
High transimission of visible  
and partially of UV-light  
  
Lowest among all plastics  
Very high  
  
Immiscible / Easy release  
  
Inj. / Ext. / Coat  
Excellent flowability

## Characteristic

Heat resistance  
Mechanical strength  
Rigidity  
Elongation  
Water absorption  
Chemical resistance  
Transparency  
UV / Ozone resistance  
Density  
Gas permeability  
Affinity  
  
Processing

## DISADVANTAGE

Low distortion temp  
Weak  
Soft especially at high temp  
Brittle  
  
Weak against oil / hydrocarbon  
  
Weak  
  
Difficult to adhere  
Difficult to mix with other plastics  
Blow / Extension  
Easy Degradation  
Hard plasticization

## Precautions

### 1. General Precautions

- The data contained in this brochure are representative examples of actual measurement values recorded on the basis of our testing methods. The information contained herein are based on the information, data, etc. that are available at the moment. However, we do not provide any warranty as to the accuracy or suitability thereof for any particular applications.
- For detailed technical information, please contact us.
- For detailed safety information, please refer to the Materials Safety Data Sheet for TPX™.
- Please take care of industrial property rights with respect to the applications described in this brochure. Before using TPX™, please evaluate the practical applicability of TPX™ and check to be certain that there will be no problem in using it.
- Please avoid fire, direct sunshine, water wetting and any abrupt change in temperature in the place of storage of TPX™.
- Please avoid the outdoor use of TPX™ for a long period of time. Use of TPX™ for a long period may cause a change in color or a deterioration in quality.
- These precautions are given on the assumption that TPX™ will be used in a normal way. If TPX™ is used in any special way, please take additional safety measures appropriate for such particular application or use.

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

- Please contact us when you study any such applications.
- It is declined to use TPX for Medical applications in principle.

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