

Transparent ABS**TOYOLAC™****Type 920 and 900 series**

Features of Transparent ABS 920 and 900 series

1. More economical than PC
2. Higher impact strength than PMMA
3. Easy handling and good moldability as standard ABS

Comparison of transparent plastics

	920	PC	SBS	MBS	PMMA	AS	PS
Density	1.06	1.20	1.00	1.00	1.16	1.08	1.04
Light transmission	87	90	90	88	92	92	75-90
Impact strength	10-15	65-87	1-1.5	1-2	1-2	2-3	1.6
Moldabitliy	Best	Poor	Best	Best	Fair	Fair	Good
Weather stability	Fair	Good	Fair	Poor	Good	Good	Good

Types of 900 series

920	Standard type
900	High rigidity
930	High impact strength

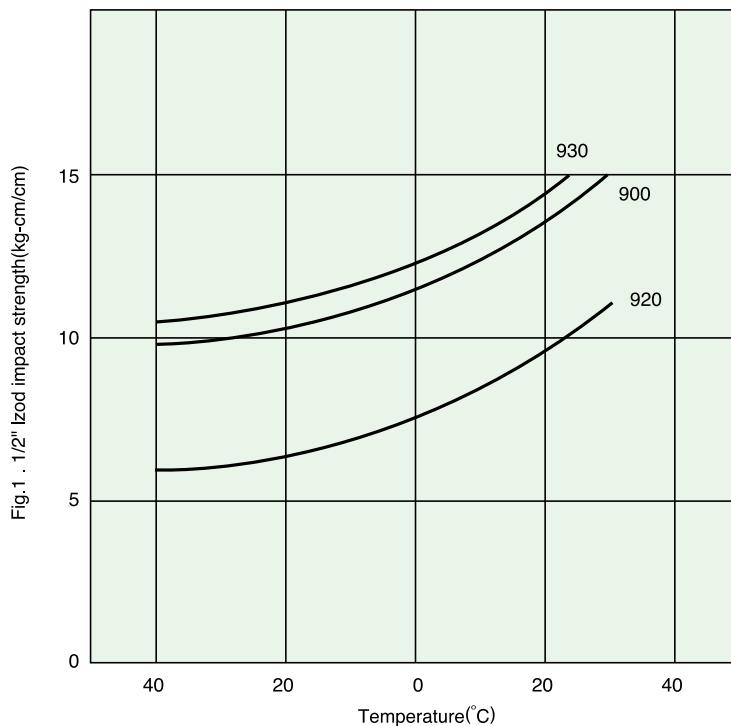
Note: These values are typical data for this product under specific test conditions and not intended for use.

Toray Industries, Inc.

1.1 Mechanical properties

Fig.1 shows the relationship between impact resistance and temperature.

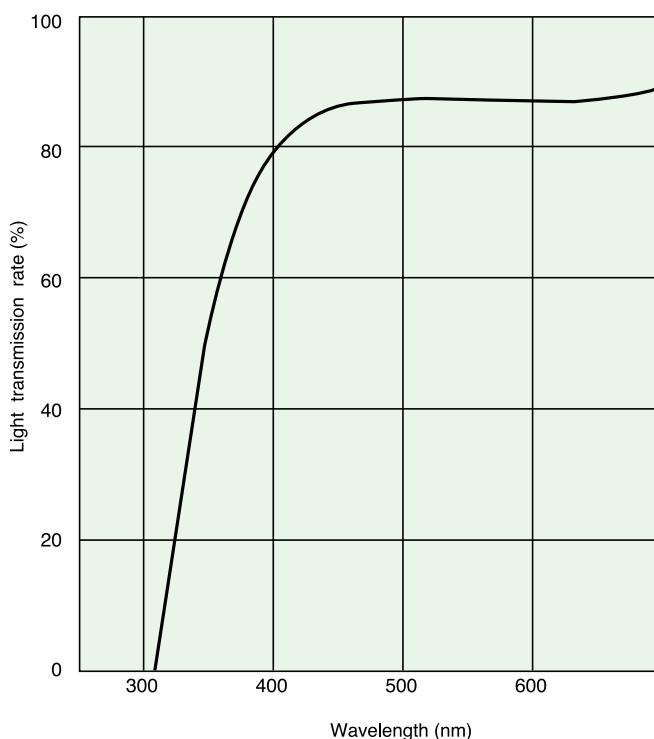
Fig.1 . 1/2" Izod impact strength at various temperatures



1.2 Transparency

Fig.2 represents the relationship between TOYOLAC 900 series resin's transparency (light transmission rate) and the wavelength.

Fig.2 . Light transmission rate curve
(Grade: 900, Thickness of sample sheet: 4 mm, Temperature: 23°C,
Measured with a Hitachi type 124 spectrometer)



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1.3 Chemical resistance

With the exception of concentrated sulfuric acid, concentrated nitric acid, and concentrated hydrochloric acid, TOYOLAC 900 series resins are only minimally affected by inorganic chemicals and their transparency is not affected at all by water, acid, or alkali. Contact with inorganic chemicals, aromatic solvents, and strong polarity solvents will cause the mold to swell or dissolve. TOYOLAC 900 series resins are resistant to petroleum-type solvents, animal, and plant oils and fats. Table 1 shows the test results of the chemical resistance of TOYOLAC 900 series resins.

Table 1
Test results of chemical resistance of TOYOLAC 900 series

(Immersion: Room temperature, 7 days)

Chemical	Weight change (%)	Tensile strength Change (%)	Change in appearance
Water	+ 0.30 - 0.42	100.0 - 103.0	None
Hydrochloric acid 10%	+ 0.20 - 0.26	98.0 - 99.5	None
Hydrochloric acid 35%	+ 0.61 - 0.72	98.0 - 99.0	Becomes slightly white
Sulfuric acid 1%	+ 0.35 - 0.42	100.0 - 101.8	None
Sulfuric acid 10%	+ 0.24 - 0.30	97.5 - 99.0	None
Sulfuric acid 30%	+ 0.05 - 0.07	101.0 - 102.1	Becomes slightly yellow
Nitric acid 10%	+ 0.33 - 0.38	101.5 - 103.7	None
Nitric acid 40%	+ 1.25 - 1.50	-	Becomes slightly yellow
Phosphoric acid 10%	+ 0.33 - 0.37	102.0 - 103.3	None
Caustic soda 1%	+ 0.33 - 0.39	98.5 - 99.5	None
Caustic soda 10%	+ 0.30 - 0.34	97.6 - 98.4	None
Caustic soda 40%	+ 0.05 - 0.09	97.0 - 97.8	None
Ammonia water 10%	+ 0.40 - 0.53	97.0 - 98.0	None
Ammonia water 28%	+ 0.55 - 0.65	100.0 - 100.8	Becomes slightly yellow
Saline solution 10%	+ 0.33 - 0.38	99.0 - 99.9	None
Calcium chloride 10%	+ 0.35 - 0.40	98.1 - 99.2	None
Sodium carbonate 2%	+ 0.32 - 0.39	96.0 - 97.0	None
Hydrogen peroxide 3%	+ 0.35 - 0.44	96.0 - 97.2	None
Sodium thiosulfate 10%	+10.28 - 0.32	98.3 - 99.1	None
Methyl alcohol	+10.30 - 13.10	33.0 - 37.0	Slightly softens and becomes white
Ethyl alcohol	+ 2.85 - 4.10	71.5 - 79.2	Slightly softens and becomes white
Ethyl alcohol 50%	+ 0.48 - 0.56	102.5 - 103.6	None
Isopropyl alcohol	+ 0.26 - 0.30	97.0 - 98.0	None
Ethylene glycol	- 0.10 - 0.15	99.1 - 99.7	None
Formic acid 80%	+14.85 - 15.56	55.0 - 60.0	Slightly softens and becomes white
Acetic acid 5%	+ 0.40 - 0.48	100.0 - 100.5	None
Acetic acid 50%	+ 0.63 - 0.70	101.8 - 102.8	Becomes slightly yellow
Oleic acid	0.00 - 0.05	102.5 - 103.5	None
Citric acid 10%	+ 0.33 - 0.40	98.2 - 99.2	None
Formalin 37%	+ 0.28 - 0.35	100.5 - 101.3	None
n-Heptane	+ 0.28 - 0.35	104.0 - 106.0	Becomes slightly yellow
Acetone	-	-	Dissolves
Methyl ethyl ketone	-	-	Dissolves
Ethyl acetate	-	-	Dissolves
Cyclohexane	+ 3.00 - 3.65	85.0 - 87.5	Becomes slightly yellow
Benzene	-	-	Dissolves
Toluene	-	-	Dissolves
Phenol	+10.50 - 12.00	69.5 - 73.0	Softens and becomes white
Aniline	-	-	Dissolves
Chloroform	-	-	Dissolves
Carbontetrachloride	-	-	Dissolves
Petroleum ether	+ 0.10 - 0.15	103.0 - 106.0	Becomes slightly yellow
Turpentine oil	+ 0.40 - 0.55	104.0 - 104.9	None
Olive oil	-	-	None
Whale oil	+ 0.10 - 0.15	100.8 - 101.5	None
Turbine oil	+ 0.05 - 0.09	100.0 - 100.5	None
Machine oil	- 0.05 - 0.08	102.0 - 104.0	None

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1.4 Coloring

As the main feature of TOYOLAC 900 series resins is its transparency, it is mainly used for applications where transparency is required. TOYOLAC 900 series resins can also be easily colored for use where bright color is needed.

In fact, coloring TOYOLAC 900 series resins is easier than coloring natural grade TOYOLAC 100 resin, known for its good coloring properties.

If required, TOYOLAC 900 series resins can be supplied in their natural color. Mixing other resins or even other types of TOYOLAC with the 900 series, however, must be avoided as even a slight amount of mixing will cloud its transparency.

1.5 Molding of TOYOLAC 900 series

The molding methods used with general ABS resins can also be applied to transparent ABS resins.

(1) Pre-drying

It is recommended that pre-drying be conducted in ovens for 2 - 3 hours at 80°C.

(2) Injection molding

As with general ABS resins, the injection molding conditions for TOYOLAC 900, 920, and 930 resins vary slightly depending on the type of molding machine and the shape of the molded product. As these grades have good flow properties, they can be molded easily with an ordinary injection molding machine. Lower molding temperatures are preferred as higher temperatures cause the molding to turn yellow. Typical molding conditions are as follows:

Cylinder temperature: 200 - 230°C

Injection pressure: 500 - 1,500 kg/cm²

Mold temperature: 50 - 70°C

(3) Extrusion molding

The flow properties of TOYOLAC 900, 920, and 930 are similar to those of TOYOLAC 600 (standard extrusion grade). Thus, extrusion molding can be conducted very easily. No specific problems are associated with the molding of TOYOLAC 900, 920, and 930 except that the molding temperature must not rise too high and the extrusion molding machine must be completely clean as mixing with other resins affects transparency.

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Typical properties

Properties		Units	Test method (ASTM)	Test condition	Type		
					900	920	930
Tensile properties	Yield strength	kg/cm ²	D638	23°C	410	490	360
	Elongation at yield	%		23°C	3.5	3.5	3.5
	Break strength	kg/cm ²		23°C	340	380	320
	Elongation at break	%		23°C	50	30	50
Flexural properties	Yield strength	kg/cm ²	D790	23°C	640	780	550
	Flexural modulus	kg/cm ²		23°C	19,500	23,500	17,000
Impact strength (Izod)	12.7×12.7×62.5mm (notched)	kg·cm/cm	D256 Method A	23°C	13	9	15
				0°C	12	7	13
			D256 Method A	-30°C	9	6	11
	3.2×12.7×62.5mm (notched)	kg·cm/cm		23°C	14	10	15
Rockwell hardness		R-scale	D785	23°C	108	115	101
Heat distortion temperature (unannealed)		°C	D648	18.56kg/cm ²	87	89	83
Coefficient of linear thermal expansion		mm/mm/°C	D696		1.2×10^{-4}	1.2×10^{-4}	1.2×10^{-4}
Water absorption		%	D570	23°C in water for 24 hrs.	0.3	0.3	0.3
Specific gravity			Float-and-sink method		1.07	1.08	1.07
Melt viscosity		$\times 10^3$ Poise	Plunger type viscometer	220°C	4.5~6.0	3.5~5.0	4.5~6.0
Melt flow index		g/10min.		220°C, 10kg	13~16	19~23	13~16
Flamability			UL94		94HB Black,white, and clear	94HB All colors	-

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