Denka

TX POLYMER

Possibility of chemistry

INTRODUCTION

Denka TX Polymer is the product of copolymerisation of Methyl Methacrylate (MMA) and Styrene Monomer (SM) developed by Denka's unique copolymer technology, which has excellent transparency and optical properties similar to Polymethyl Methacrylate (PMMA), despite being lightweight.

This brochure introduces various applications and benefits of Denka TX Polymer compared to PMMA.

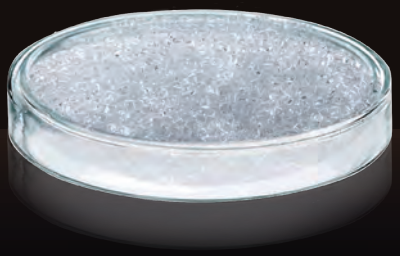
CONTENTS

TX POLYMER GRADES

There are two grades line up for TX Polymer.

TX-100S is an injection moulding grade,
which is used in applications such as thick cosmetic cases,
household containers, and spectacle lenses with glass like appearance.

TX-800LF is a sheet extrusion grade,
which is used for optical sheets applications such as light guide panel in TV,
monitor and lighting panel.
Besides it is suitable for indoor partitions applications
due to the excellent transparency and dimensional stability.



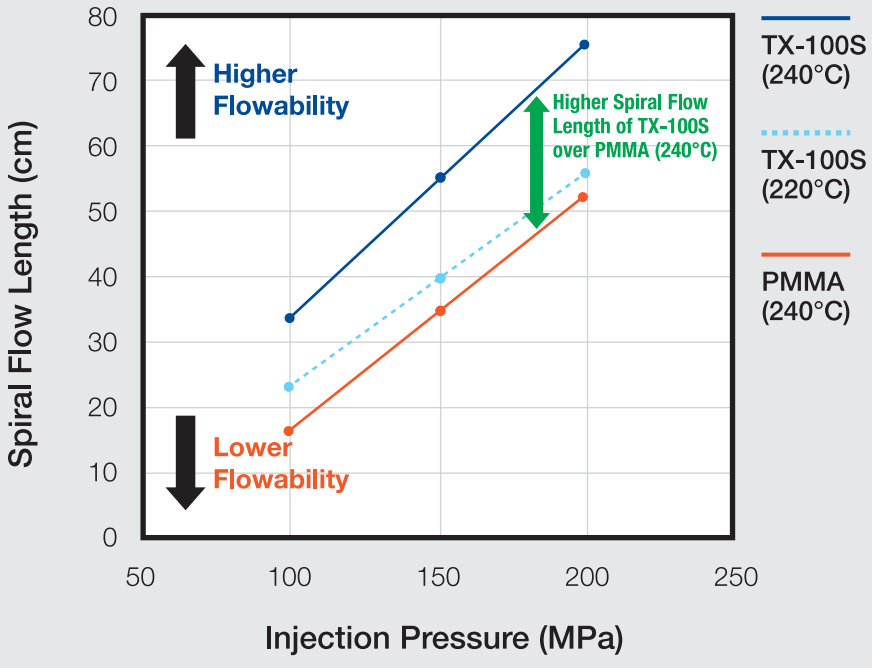
ADVANTAGES OF

TX-100S

Higher Flowability of TX-100S Compared to PMMA

From the results of spiral flow test, it can be observed that TX-100S achieves longer flow length compared to PMMA at similar injection pressure and temperature. This shows that TX-100S possesses higher flowability as compared to PMMA in injection moulding applications. Higher flowability of TX-100S allows for higher productivity compared to PMMA in injection moulding due to reduced cycle time.

Lower energy consumption during TX-100S injection moulding compared to PMMA:
Due to higher flowability of TX-100S compared to PMMA, with the use of TX-100S it is possible to reduce injection moulding temperature by 20°C and above, while achieving similar flowability performance.



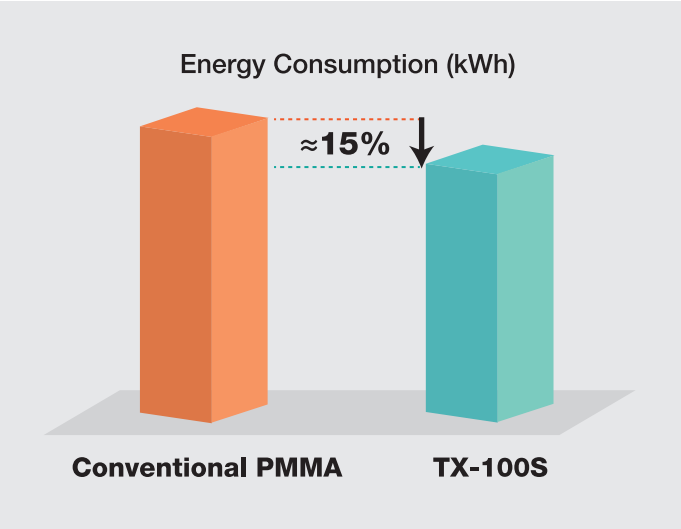
ADVANTAGES OF

TX-100S

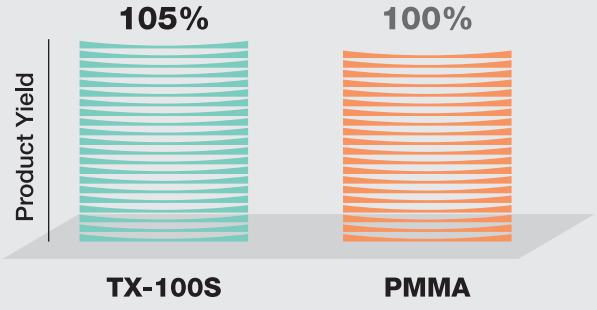
Greater Saving on Energy and Costs

For an All-Electric Injection Moulding Machine, this corresponds to approximately 10% (or more) savings in power consumption with the use of TX-100S compared to conventional PMMA.

Besides, reduction of injection moulding temperature allows for reduction in cooling time during the moulding cycle, resulting in higher productivity.



High yield of products (Low density) and weight-saving:
Due to lower density of TX-100S resins of approximately 5%, this allows injection moulded product yield of TX-100S to be 5% higher compared to PMMA,
allowing for cost savings.



High yield of products (Low density) and weight-saving

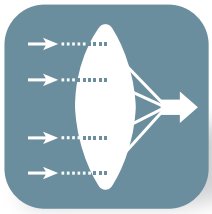
Besides, the lower density corresponds to lighter weight in injection moulding applications such as spectacle lens.

TX-100S provide greater lightweight performance for Spectacles Lens

ADVANTAGES OF

TX-100S

High Refractive Index



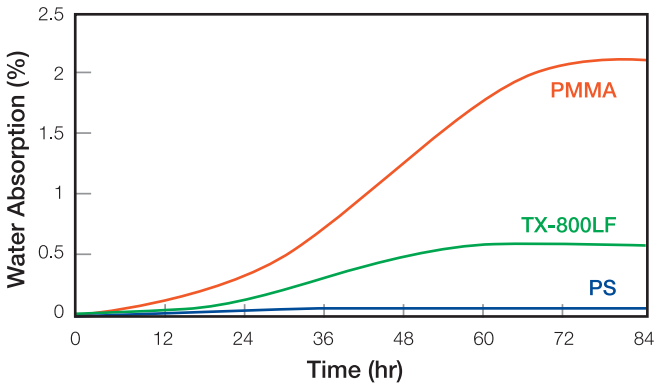
Thinner spectacle lens applications TX-100S: with a higher refractive index than PMMA, allows for thinner lens design.

ADVANTAGES OF

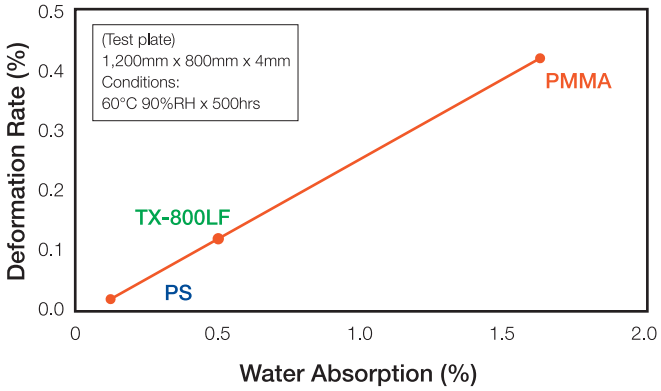
TX-800LF

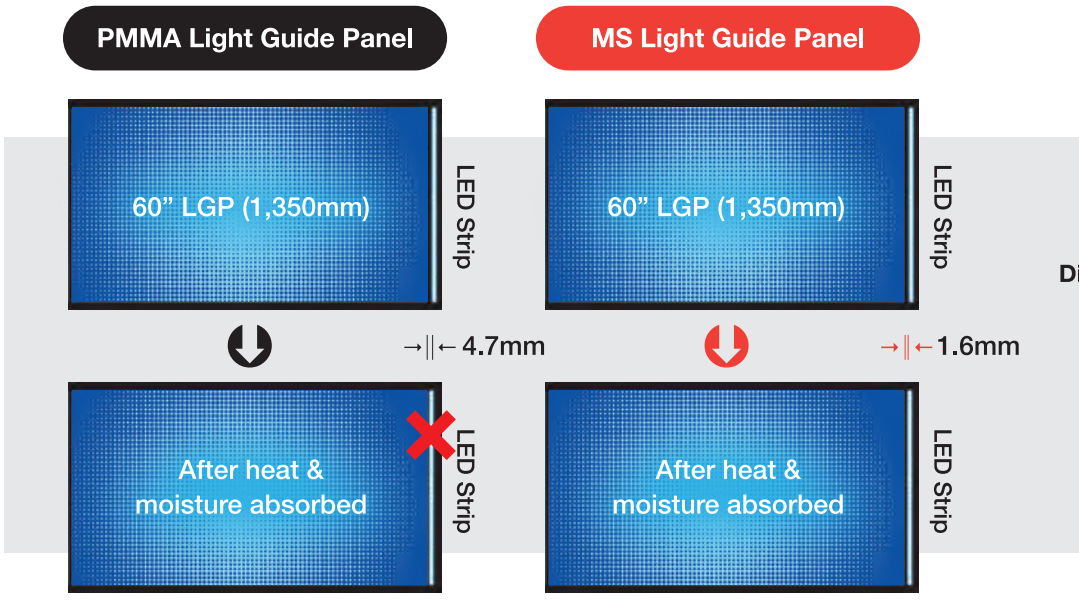
High Dimensional Stability

TX Polymer is a copolymer of PS and PMMA.
Due to the presence of low moisture absorption PS component, TX-800LF has 3 times better dimensional stability than PMMA due to the low moisture absorption. Lower moisture absorption corresponds to lower deformation rate of light guide plate.



Compared to usage of PMMA material, this allows the edge-lit LED strip to be designed for a closer gap between the edge of the TX-800LF light guide plate and the LED strip, resulting in narrower bezel design, and hence subsequently thinner product design. Besides, high dimensional stability of TX-800LF can also result in less warp of plate, which is an advantage for thinner sheets.





Dimensional stability advantage of TX-800LF for Light Guide Plate Applications

ADVANTAGES OF

TX-800LF

Design Flexibility

Narrow Bezel

Lighting Applications and Partition

Greater dimensional stability of TX-800LF is advantageous in sheet applications exposed to high humidity, such as light guide panel in refrigerator lighting applications and clear shower partition in the bathroom.

Lighting Panel

Light Guide Plate for LED Lighting compartment in Refrigerator

Bathroom Partition

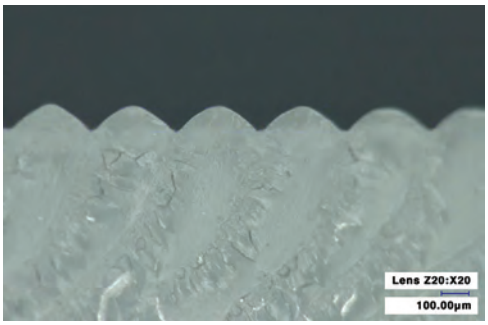
ADVANTAGES OF

TX-800LF

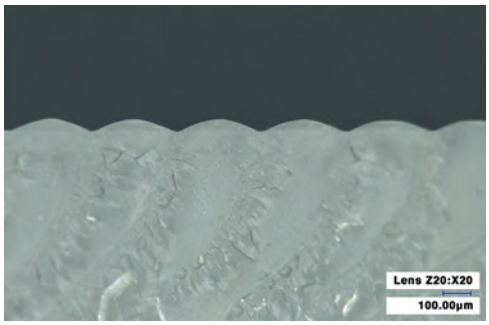
Easy to Pattern for Optical Sheet

TX-800LF has good printability compared to PMMA for the various optical patterning even at low temperature, increasing the contrast of the light guide plate print pattern, which in turn enhances the stability of optical properties.

Printed pattern of TX-800LF vs. PMMA.



TX-800LF



PMMA

Chemical Resistance for Alcoholic Disinfectant

Compared to PMMA, TX-800LF are preferably used for applications such as transparent panel that require wiping using alcoholic-based disinfections for sanitation purposes due to the high chemical resistance. From experimental study comparing immersion of TX-800LF and PMMA plates in Ethanol solution, appearance of TX-800LF remains intact unlike PMMA (whitening observed).

Ethanol solution Immersion Test (1 Day)

GENERAL PROPERTIES

Properties		Methods	Conditions	Units	TX-100S Injection Molding	TX-800LF Extrusion	cf. PMMA
Composition	MMA Content	–	–	%	≒60	≒50	≒100
Melting Properties	Melt Mass-Flow Rate	ISO 1133	200°C, 49N	g/10min	1.8	1.6	0.4
			230°C, 37.3N	g/10min	9.5	8.0	2.0
Optical Properties	Refractive index	ISO 489	Sodium D Line	–	1.54	1.55	1.49
	Total Transminttance	ISO 13468	2mmt	%	92	92	93
	Haze	ISO 14782	2mmt	%	0.2	0.2	0.2
Mechanical Properties	Tensile Stress at Break	ISO 527	5mm/min, 23°C	MPa	67	64	74
	Flexural Stress	ISO 178	2mm/min, 23°C	MPa	110	110	120
	Flexural Modulus			MPa	3,300	3,300	3,300
	Izod Impact Strength	ISO 180	Notched , 23°C	kJ/m²	2	2	2
	Charpy Impact Strength	ISO 179	Notched , 23°C	kJ/m²	2	2	2
	Rockwell Hardness	ISO 2039	M Scale	–	92	85	105
Thermal Properties	Vicat Softening Temperature	ISO 306	50N	°C	100	100	105
	Deflection Tempurature Under Load	ISO 75	1.8MPa, Flatwise Unannealed	°C	80	80	85
			1.8MPa, Flatwise Annealed	°C	95	95	104
Other Properties	Density	ISO 1183	23°C	–	1,127	1,111	1,190
	Flammability	UL94	1.5mm	–	HB	HB	–

Note: The data listed in the table represents typical values for TX Polymer and PMMA obtained by reliable sources and is provided for informational purposes only. It is given in good faith and should not be used as a basis to establish specification limits or design criteria. It is the responsibility of the User to evaluate and determine the suitability of our product for a particular use or intended application. For more detailed information, please contact us.

CHEMICAL RESISTANCE OF TX-POLYMER FOR VARIOUS CATEGORIES OF SUBSTANCES

Category	Suitable	Requires Attention	Unsuitable
Mineral Oil, Grease, Synthetic Oil	Paraffin Oil	Cup grease 101, Spindle Oil, Sillicon Oil	Gasoline (Regular) Gasoline (High Octane)
Animal Vegetable Fats and Oils		Almond Oil, Coconut Oil, Cod-liver Oil Olive Oil, Palm Oil, Peanut Oil, Sesame Oil Salad Oil, Soybean Oil, Lecithin, Lard Linseed Oil, Lanolin, Rapeseed Oil Walnut Oil, White Wax	Cedar Oil Orange Oil Peppermint Oil Nutmeg Oil
Organic Solvent, Industrial Solvent	Liquid Paraffin Vaseline	Paraffin	Acetone, Chloroform Chloroflurocabon Methyl Ethyl Ketone n-heptane, Toluene, Kerosene Tetrahydrofuran, Xylene
Alcohol, Glycol	Ethanol, Ethylene Glycol Glycerol Fragrance Alcohol (50A40)	Allyl Alcohol, Butanol, Isopropyl Alcohol Isobutanol, Fragance Alcohol (50A40) Methanol, 1-Pentanol, 1-Octanol n-Propyl Alcohol, 1-Undecanol	Butanol
Inorganic Acid	Hydrochlonic Acid 10% Saturated Boric Acid 10%	Hydrochlonic Acid 30%, Nitric Acid 20% Sulphuric Acid 30%, Phosphoric Acid 10%	
Organic Acid	Acetic Acid 10% Oxalic Acid 10% Lactic Acid 10%	Acetic Acid 50%, Citric Acid 10% Olkeic Acid, Stearic Acid,Tartaric Acid	
Inorganic Base	Caustic Soda 10%	Ammonia, Aluminium Hydroxide Caustic Soda 50%	
Salt	Aluminium Chloride (Saturated) Calcium Chloride (Saturated) Seawater, Sodium Benzoate Zinc Oxide (Powder) Zinc Stearate	Sodium Sulphite, Sodium Chloride 10% Sodium Carbonate 2% Sodium Hydrochlorite	
Household Chemicals, Cosmetic, Shampoo, Others	Alpecin Liquid, Hair-Stick Pomade, Urea 5%	Hydrogen Peroxide 3% Neutral Detergent (Powder), Hair-tonic Neutral Detergent (Liquid), Lipstick	Naphthalene
Beverage, Seasoning, Food	Distilled Water Grape Juice Black Tea (Powder) Coffee (Powder) Milk (Powder), Honey Soy Sauce, Miso Strawberry Jam Pickled Plum, Kimchi Vegetables Pickled in Mustard Yellow Pickled Radish Red Pickled Ginger Chinese Onion	Carbonated Water, Gin, Whisky Japanese Sake, Orange Juice, Orange Peel Pineapple Juice, Mandarin Orange Juice, Tomato Juice Coke, Milk (Liquid) Lemon Juice, Vinegar, Pepper Mustard, Chocolate, Cheese, Beef	Butter Margarine Mayonnaise

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