Bayer
Plastics Division

Chemical and Solvent Resistance of Texin® and Desmopan® Thermoplastic Polyurethanes

Product Information

Introduction

This report summarizes the physical properties of Texin 285 and Desmopan 453 resins after immersion in a variety of chemicals and solvents for 12 months. Similarly, the results of immersion of Texin 390 resin for 9 months are also presented. All immersions were done at room temperature (72°F/22°C).

Summary

The physical properties noted after immersion for 1 month and 6 months were not markedly changed by continuing the immersion for longer periods.

Texin 390 and Desmopan 453 resins are about equal in resistance to selected fluids and somewhat superior to Texin 285 resin. Weak acids and ammonia solutions are more destructive than other weak alkalis, detergents, or neutral salt soutions. Similarly, chlorinated organic solvents and alcohols are more destructive than hydrocarbons.

Experimental Procedure

Injection-molded plaques (3" x 6" x 1⁄8") of Texin 285 resin were allowed to cure at room temperature for a minimum of 1 month before commencing the immersion tests. Plaques of the same size for Texin 390 and Desmopan 453 resins were heat-cured for 16 hours at 200°F (93°C). Immersion tests were started 10 days later.

The inorganic chemicals were mixed and dissolved in laboratory-deionized water in the percentages (by weight) given in the tables. The organic solvents, oils, and proprietary fluids were used as provided by the suppliers without modification.

Immersions were made at room temperature in 16-ounce glass bottles with metal screw caps and paper liners. The samples were completely immersed in the liquid. The general provisions of ASTM D 543 (ISO 175) were followed throughout. At the end of the immersion period, specimens were rinsed with water or acetone, blotted dry, measured, and tested as quickly as possible. Thus, the data presented are characteristic of the material in the swelled condition. Specimens were not allowed to dry out.

Swelling and Appearance

Swelling of the samples was observed only from immersion in organic solvents. It was noted that penetration by solvents and subsequent swelling occurs to the greatest extent during the first few weeks of immersion. Swelling was often accompanied by discoloration of the samples as noted in the “Remarks” column. These colors were mostly ascribed to dyes in the proprietary fluids.

Physical Properties

In general, tear strength is more susceptible than tensile strength to degradation by solvents and chemicals. Organic solvents (especially those with a high solubility parameter) are generally readily absorbed by Texin and Desmopan resins. The swelling results in moderate loss of tear strength, while tensile strength is much less affected.

The results of 12 months' immersion on the physical properties of Texin 285 and Desmopan 453 resins are given in Tables I and III, respectively. Table II gives the results of 9 months' immersion on the properties of Texin 390 resin. The resultant values are shown for tensile strength, elongation, tensile elongation set, tear strength, Shore hardness, and percent swell. The tensile properties were obtained in accordance with ASTM D 412 (ISO 37), while split tear resistance was determined by Federal Test Method 4221. Swelling percentages are reported on a linear basis.

Use of Data

ASTM D 543 (ISO 175) is intended for testing of plastic materials for resistance to chemical reagents. This method provides for reporting changes in weight, dimensions, appearance, and strength properties. Provisions are made for various reagents, exposure times, concentration of reagents, and temperatures of the test. The specification of these conditions provides a basis for standardization and serves as a guide to investigators wishing to compare the relative resistance of various plastics to typical chemical reagents.

Correlation of tests results with the actual performance of serviceability of plastics is necessarily dependent upon the similarity between testing and end-use conditions. Thus, the data provided in this report are intended to serve only as a guide for general information on the chemical and solvent resistance of Texin and Desmopan resins. ***As is the case with any compatibility test, results are dependent on such variables as concentration, time, temperature, part design, and residual stresses. It is imperative that production parts be evaluted under actual application conditions prior to commercial use.***

For applications involving continuous immersion, the data obtained in short-term tests are of interest only in eliminating the most unsuitable materials or indicating a probable relative order of resistance to chemical reagents. Evaluation of plastics for special applications involving corrosive conditions should be based on the particular reagents and concentrations to be encountered. The test conditions should take into account the manner and duration of contact with reagents, the temperature of the system, and other performance factors involved in the particular application.

Health and Safety Information

Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling Texin and Desmopan resins. Before working with any Bayer product mentioned in this publication, you must read and become familiar with the available information concerning its hazards, proper use, and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets and products labels. Consult your Bayer Corporation representative or contact the Product Safety and Regulatory Affairs Department in Pittsburgh, Pa. For materials mentioned that are not Bayer products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be followed.

Table I
Solvent and Chemical Resistance* of Texin 285 Resin
(Immersion: 12 Months at 72°F/22°C)

Media	Tensile psi	Elongation %	Tensile Elongation Set, %	Tear Strength lbf/in	Hardness, Shore A	Swell, %	Remarks
Original Values	7400	550	12	440	86	0	
Acids							
Acetic, 5%	470	140	10	35	73	<0.5	
Hydrochloric, 10%			Disintegrated			—	Failed
Nitric, 1%			Disintegrated			—	Failed
Nitric, 10%			Disintegrated			—	Failed
Oleic	2500	840	180	300	79	0.5	Yellow
Alkali Solutions							
Ammonia, 10%	440	80	2	90	80	2.5	Snow White
Soap (Ivory[1]), 1%	6000	650	60	385	84	<0.5	
Sodium Hydroxide, 10%	2900	560	50	305	82	<0.5	Dark Brown Coating
Detergent (Tide[2]), 1%	5800	600	52	370	83	<0.5	
Aqueous Solutions							
Calcium Chloride, Saturated	7500	580	24	465	86	<0.5	
Coca-Cola[3]	6400	620	54	350	84	<0.5	
Hydrogen Peroxide, 3%	5100	680	60	335	83	<0.5	
Isopropanol, 50%	3800	650	72	305	75	5.0	White Coating
Sodium Chloride, 10%	5700	600	50	380	86	<0.5	
Sodium Hypochlorite, 5%	1100	560	112	295	77	<0.5	
Sodium Thiosulfate, 20%	6100	630	50	390	85	<0.5	
Water, Deionized	5900	650	54	385	83	<0.5	
Organic Liquids							
Acetone	1600	700	64	50	38	37.5	
Benzene	2900	600	60	40	68	24.0	
Brake Fluid (Wagner Lockheed[4] 21-B)	2200	830	110	315	54	17.5	
Carbon Tetrachloride	4000	580	54	135	78	12.5	
Ethyl Acetate	2300	660	54	50	63	25.0	
Ethyl Ether	4300	610	60	235	78	7.5	Cloudy
N-Ethyl Morpholine			Excessive Swelling			75.0	Yellow — Failed
Ethylene Dichloride	1000	450	20	10	48	51.5	Reddish
Ethylene Glycol Coolant	7300	620	30	390	85	<0.5	
Flexol[5] Plasticizer 10-10	7700	610	16	430	85	<0.5	
Freon[6] 113	7000	580	30	380	84	2.5	
Fuel Oil, ASTM-A	8300	620	24	420	85	<0.5	
Fuel Oil, ASTM-B	5100	620	60	220	82	5.0	
Fuel Oil, ASTM-C	4700	620	60	215	78	7.5	White Coating
Gasoline, Premium	5700	640	54	300	82	4.0	Brown
Glycerol	7500	560	24	445	85	<0.5	
Hexane	7400	590	24	385	85	<0.5	
Hydraulic Fluid (Skydrol[7] 500-A)	700	620	32	25	20	55.0	Purple
Jet Fuel, JP-4	6500	610	40	395	83	2.0	
Methanol	1700	820	180	215	70	6.0	Dirty White
Oil, Transmission A	9200	610	18	405	84	<0.5	
Petroleum (Texas Sour Crude)	8100	590	26	390	85	2.5	Yellow
Toluene	3300	560	60	65	72	17.5	
Turpentine	7100	600	28	375	83	2.5	Lemon Yellow

** These items are provided as general information only. They are approximate values and are not part of the product specifications.*

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[2] Tide is a trademark of The Procter and Gamble Company.

[3] Coca-Cola is a trademark of The Coca-Cola Company.

[4] Wagner Lockheed is a trademark of Wagner Electric Corporation.

[5] Flexol is a trademark of Union Carbide Chemicals & Plastics Technology.

[6] Freon is a trademark of E.I. DuPont DeNemours and Company.

[7] Skydrol is a trademark of Solutia Incorporated.

Table II
Solvent and Chemical Resistance* of Texin 390 Resin
(Immersion: 9 Months at 72°F/22°C)

Media	Tensile psi	Elongation %	Tensile Elongation Set, %	Tear Strength lbf/in	Hardness, Shore A	Swell, %	Remarks
Original Values	7700	500	52	530	91	0	
Acids							
Acetic, 5%	1200	320	70	115	85	<0.5	White
Hydrochloric, 10%			Disintegrated			<0.5	Failed
Nitric, 1%	0	0	0	40	89	1.5	Failed
Oleic	7100	580	70	610	90	<0.5	
Alkali Solutions							
Ammonia, 10%	2100	560	90	330	85	3.0	Snow White
Soap (Ivory[1]), 1%	5600	520	50	530	90	<0.5	White
Sodium Hydroxide, 10%	4200	500	50	395	84	<0.5	Dark Brown Coating
Detergent (Tide[2]), 1%	5900	520	48	525	90	<0.5	White
Aqueous Solutions							
Coca-Cola[3]	5400	520	50	555	91	<0.5	Lemon Yellow
Hydrogen Peroxide, 3%	5800	570	58	530	88	<0.5	
Isopropanol, 50%	3600	590	60	355	82	4.0	White
Sodium Hypochlorite, 5%	3200	500	78	490	86	<0.5	
Water, Deionized	6400	520	50	425	91	<0.5	
Organic Liquids							
Ethyl Ether	4900	580	60	325	85	<0.5	White
Ethylene Glycol Coolant	7400	540	44	530	90	1.0	Pink
Flexol[4] Plasticizer 10-10	7200	500	44	580	92	<0.5	White
Freon[5] 113	7200	530	46	545	92	1.5	White
Fuel Oil, ASTM-A	7900	530	50	620	92	<0.5	
Fuel Oil, ASTM-B	5600	580	62	390	76	<0.5	White
Gasoline, Premium	6400	580	58	400	86	3.0	Brown
Jet Fuel, JP-4	6900	540	52	505	88	2.0	White
Methanol	3100	730	120	255	78	5.5	White
Oil, Transmission A	7800	510	50	580	91	<0.5	Dark Red
Toluene	3600	530	52	145	81	12.5	White
Turpentine	7000	520	50	540	91	2.5	Yellow

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Table III
Solvent and Chemical Resistance* of Desmopan 453 Resin
(Immersion: 12 Months at 72°F/22°C)

Media	Tensile psi	Elongation %	Tensile Elongation Set, %	Tear Strength lbf/in	Hardness, Shore A	Swell, %	Remarks
Original Values	5000	450	60	750	54	0	
Acids							
Acetic, 5%	1400	60	6	50	36	<0.5	
Hydrochloric, 10%			Disintegrated			—	
Nitric, 1%	1100	70	4	440	47	<0.5	
Nitric, 10%			Disintegrated			—	
Oleic	2700	420	86	410	50	1.5	Dark Yellow
Alkali Solutions							
Ammonia, 10%	1400	60	8	80	44	1.3	Blisters, White
Soap (Ivory[1]), 1%	3600	390	70	560	50	<0.5	
Sodium Hydroxide, 10%	1600	400	66	360	51	<0.5	Dark Brown Coating
Detergent (Tide[2]), 1%	3800	430	60	600	51	<0.5	
Aqueous Solutions							
Calcium Chloride, Saturated	4100	400	48	775	55	<0.5	
Coca-Cola[3]	3800	430	64	570	50	<0.5	
Hydrogen Peroxide, 3%	3700	480	82	490	50	<0.5	
Isopropanol, 50%	3600	510	90	305	40	2.5	Tan
Sodium Chloride, 10%	3900	470	68	545	55	<0.5	
Sodium Hypochlorite, 5%	2200	340	76	450	45	<0.5	
Sodium Thiosulfate, 20%	3900	460	66	555	53	<0.5	
Water, Deionized	3900	440	64	620	51	<0.5	
Organic Liquids							
Acetone	2300	520	100	125	30	12.5	White
Benzene	3100	500	80	155	49	11.0	Light Pink
Brake Fluid (Wagner Lockheed[4] 21-B)	3000	570	96	285	39	7.0	White
Carbon Tetrachloride	4000	500	60	320	50	7.0	Light Pink
Ethyl Acetate	2800	510	90	170	38	10.0	White
Ethyl Ether	3700	520	88	340	42	5.0	Light Tan
N-Ethyl Morpholine	600	70	8	30	20	18.0	Failed
Ethylene Dichloride	2200	470	80	85	30	20.0	Dark Purple
Ethylene Glycol Coolant	4700	460	62	665	51	<0.5	
Flexol[5] Plasticizer 10-10	4500	420	48	785	54	<0.5	
Freon[6] 113	5000	460	54	575	50	2.0	
Fuel Oil, ASTM-A	4900	460	60	700	54	<0.5	
Fuel Oil, ASTM-B	4200	500	76	430	50	2.5	Light Pink
Fuel Oil, ASTM-C	4200	500	76	295	43	5.0	Tan
Gasoline, Premium	4700	510	74	430	47	2.5	Brown
Glycerol	5000	470	60	740	55	<0.5	
Hexane	4700	450	56	660	50	<0.5	
Hydraulic Fluid (Skydrol[7] 500-A)	2500	480	66	150	37	10.0	Gray-Purple
Jet Fuel, JP-4	4800	500	70	590	48	1.5	
Methanol	1500	260	50	140	35	5.0	Light Pink
Oil, Transmission A	4500	440	56	720	53	<0.5	
Petroleum (Texas Sour Crude)	5100	450	60	650	53	2.0	Yellow
Toluene	3400	480	76	210	45	9.0	Light Pink
Turpentine	2700	500	96	265	40	6.0	Yellow

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