



UBE Polyimide Film Exhibits Industry Leading Heat Resistance

UPILEX®

ユーピレックス

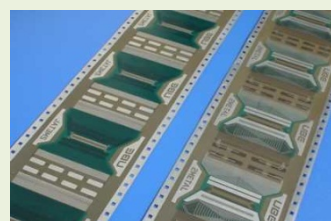
Super-heat resistant polyimide film produced from UBE's exclusive "BPDA (Biphenyl tetracarboxylic dianhydride)" monomers.

This formulation is unique to UBE and exhibits outstanding dimensional stability, low water absorption and very high chemical resistance.

Base grade

UPILEX®-S

The standard grade of UBE polyimide "UPILEX®". Compared to other polyimide films, it has better surface smoothness and higher chemical resistance, greater stiffness and much higher heat resistance. Outgassing is very low, so it is easy to use.



Grades and Area factor of "UPILEX®-S"

Type	Grade	Thickness (μm)	Width* (mm)	Area factor (m ² /kg)
UPILEX®-S	12.5SN	12.5	508,514	54.4
	25S	25	508,514/1016,1028	27.2
	50S	50	508,514/1016,1028	13.6
	75S	75	508,514/1016,1028	9.1
	125S	125	508,514	5.4

*For custom widths, please contact us.

(1) Mechanical properties

"UPILEX®-S" delivers outstanding mechanical characteristics across a wide temperature range. It also demonstrates high tensile strength and modulus, and even features outstanding long-term heat resistance. Another exceptional feature of "UPILEX®-S" is its high resistance to hydrolysis, as demonstrated by its properties being virtually unaffected even when it is immersed in boiling water for long periods of time.

Property	Unit	Standard value								Measurement Method
		UPILEX -25S				UPILEX -50S	UPILEX -75S		UPILEX -125S	
		-269℃	-196℃	25℃	300℃	25℃	25℃	200℃	25℃	
Tensile strength	MPa	740	650	520	290	460	360	270	340	ASTM D882
Stress at 5% elongation	MPa	-	-	260	90	-	210	110	-	ASTM D882
Elongation	%	10	20	40	70	50	50	80	60	ASTM D882
Tensile modulus	GPa	-	-	9.1	3.7	9.3	6.9	3.8	7.6	ASTM D882
Tear strength-initiation [Graves]	N/mm	-	-	600	-	-	470	-	-	ASTM D1004
Tear strength-propagation [Elmendorf]	N	-	-	3.2	-	-	4.2	-	-	ASTM D1922
Folding endurance [MIT]	Cycles	-	-	>100,000	-	-	>12,000	-	-	ASTM D2176
Density	×10 ³ kg/m ³	-	-	1.47	-	1.47	1.47	-	1.47	ASTM D1505
Coefficient of kinetic friction (film-to-film)	-	-	-	0.4	-	-	0.4	-	-	ASTM D1894

(2) Electrical properties

"UPILEX®-S" exhibits excellent electrical characteristics over a wide range of temperatures and frequencies. Even at high temperatures, "UPILEX®-S" shows almost no deterioration in its electrical properties, unlike other plastic-type films. It also displays a low level of electrical insulation defects, making it an optimal choice for electrical and electronic uses that demand high reliability.

Property	Unit	Standard value				Measurement condition	Measurement Method
		UPILEX-25S		UPILEX-75S			
		25°C	200°C	25°C	200°C		
Dielectric strength	kV	6.8	6.8	11	11	60Hz	ASTM D149
Dielectric constant	-	3.5	3.3	3.3	3.2	1kHz	ASTM D150
		-	-	3.5	-	1MHz	ASTM D150
Dissipation factor	-	0.0013	0.0078	0.0038	0.0056	1kHz	ASTM D150
		-	-	0.0049	-	1MHz	ASTM D150
Volume resistivity	$\Omega \cdot m$	$>10^{14}$	$>10^{13}$	$>10^{14}$	$>10^{14}$	DC 100V	ASTM D257
Surface resistivity	Ω	$>10^{17}$	$>10^{15}$	$>10^{16}$	$>10^{15}$	DC 100V	ASTM D257

(3) Thermal properties

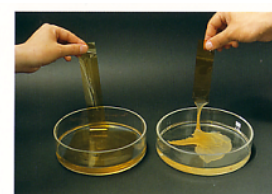
"UPILEX®-S" boasts the highest heat resistance of any plastic film currently available. Its major features include a high starting temperature for thermal decomposition, smaller values for both heat shrinkage and thermal linear expansion coefficients, as well as flame resistance (UL94 VTM-0). Therefore, "UPILEX®-S" changes little in size even when heated. This makes it ideal for use in FPC and TAB-tape substrates composed of minute circuits.

Property	Unit	Standard value				Measurement condition	Measurement Method
		UPILEX-25S	UPILEX-50S	UPILEX-75S	UPILEX-125S		
Thermal linear expansion coefficient (50-200°C)	ppm/°C	12	16	20	22	Rise rate of temperature 5°C/min	Fine linear dilatometer
Heat shrinkage	%	0.05	0.02	0.01	0.01	200°C, 2h	ASTM D1204
Melting point	°C	なし				-	-
Specific heat	kJ/(kg·K)	1.13				-	Differential scanning calorimeter
Heat life (Tensile strength)	°C	290				20,000h	Fixed temperature method
Flammability	-	V-0				-	UL94
Oxygen index	%	66				-	JIS K7201
Thermal conductivity	W/(m·K)	0.29				Thickness direction	Laser flash method

(4) Chemical-resistant properties

"UPILEX®-S" is insoluble in all organic solvents and is sufficiently resistant to virtually all chemicals, including inorganic acid and alkali solutions. This chemical resistance provides exceptional physical properties as well as superior dimensional stability when "UPILEX®-S" is exposed to chemicals.

As resistance to various automotive oils (engine oil, brake oil, gasoline, etc.) is strong, it is suitable for use in many automotive applications.



UPILEX General Polyimide

Property	Standard value (UPILEX-25S)			Measurement condition	Measurement Method		
	Strength retention (%)	Elongation retention (%)	Modulus retention (%)				
Chemical resistance	10% sodium hydroxide	80	60	95	25°C 5days Immersion	ASTM D882	
	Glacial acetic acid	100	95	100	110°C 5weeks Immersion		
	Water	PH=1.0	95	85	100		100°C 2weeks Immersion
		PH=4.2	95	85	100		100°C 2weeks Immersion
		PH=8.9	95	85	100		100°C 2weeks Immersion
		PH=10.0	95	85	100		100°C 4days Immersion
Water absorption	1.4%			23°C 24h Water Immersion	ASTM D570		
	0.8%			50°C RH60% Equilibrium			
Gas permeability	Water vapor	1.7×10 ⁻³ kg/m ² /25μm			38°C, RH90%, 24h	ASTM E96	
	Oxygen	0.8×10 ⁻⁶ m ³ /m ² /25μm			30°C, 1atm 24h	ASTM D1434	
	Carbon dioxide	1.2×10 ⁻⁶ m ³ /m ² /25μm			30°C, 1atm 24h	ASTM D1434	

(5) Comparison of film properties

General properties of various heat-resistant films

Property	Unit	UPILEX-25S	General Polyimide	Polyester	Polysulfone	Polytetra fluoroethylene
Density	$\times 10^3 \text{kg/m}^3$	1.47	1.42	1.38-1.41	1.24-1.25	2.1-2.2
Tensile strength	MPa	520	170	140-250	60-70	10-30
Elongation	%	40	70	60-170	60-110	100-400
Tensile modulus	GPa	9.1	3.0	-	-	-
Tear strength-propagation [Elmendorf]	N	3.2	3.1	4.9-10.8	3.9-4.9	3.9
Chemical resistance	Organic solvents	Excellent	Excellent	Excellent	Excellent	Excellent
	Strong acids	Good	Good	Good	Excellent	Excellent
	Strong alkalis	Good	Poor	Good	Excellent	Excellent
Dielectric constant	-	3.5	3.5	3.2	3.1	2.1
Dissipation factor	-	0.0013	0.003	0.005	0.0008	0.0002

Modern Plastics Encyclopedia; McGraw-Hill, Inc., New York

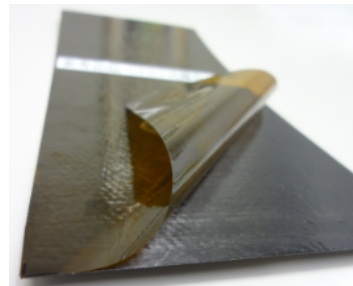
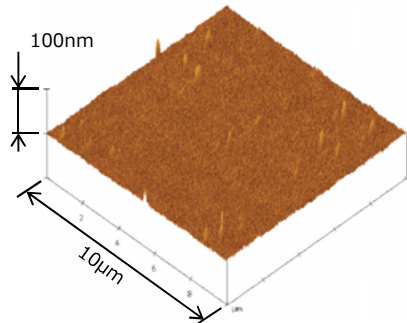
(6) Smooth surface

"UPILEX®-S" has a excellent smooth surface with low roughness. Therefore, it can also be suitably used as a film carrier base for other high heat resistance resins, cushioning materials or releasing materials.

Surface flatness

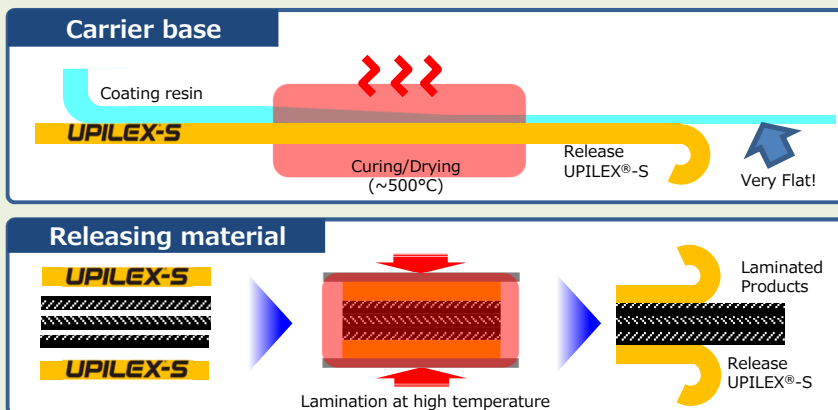
Surface Roughness	Unit	Standard value				General Polyimide	PET	Measurement method
		UPILEX -25S	UPILEX -50S	UPILEX -75S	UPILEX -125S			
Rms	nm	3.8	2.0	2.2	2.1	5.6	-	Scanning probe microscope (Scan area = 10mm x 10mm)
Ra	nm	2.1	1.2	1.3	1.1	3.2	22	
Rz	nm	64.9	60.3	57.8	51.5	100	-	

AFM Image of "UPILEX®-50S"

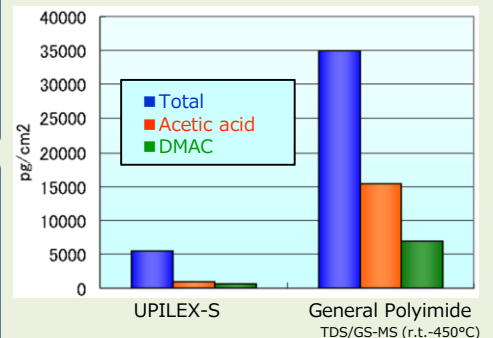


< Carrier base, Releasing material Application Examples >

Since outgassing is very low compared to general polyimide, it is the perfect film for many applications with vacuum and/or high-temperature processing. And, resin coats formed from a carrier base of "UPILEX®-S" have moderate adhesion strength to peel off later and offer a very smooth surface.



Outgassing when heated



■ ■ Adhesion strength between "UPILEX®-S" and film products ■ ■

Coated/Laminated Resin		180° Peel Strength (N/10mm)	Sample preparation (Carrier=UPILEX-25S)
Grade	Thickness (μm)		
Nitto Denko 31B	34	3.0	Laminate 31B and UPILEX-S at room temperature
	34	5.2	Laminate 31B and UPILEX-S at room temperature And leave it for 20h at 70°C
Nichiban LP24	42	2.1	Laminate LP24 and UPILEX-S at room temperature
	42	3.8	Laminate LP24 and UPILEX-S at room temperature And leave it for 20h at 70°C
Epoxy Resin	38	1.2 ¹⁾	Coating Epoxy resin on UPILEX-S and curing 1) peel off at an angle of 90°
Epoxy Prepreg	91	1.0	Laminate epoxy prepreg and UPILEX-S
UPILEX®-25VT	25	0.08	Laminate UPILEX-25VT and UPILEX-S at 320°C
UPIA®-ST (U-Varnish-S)	26	1.1	Coating UPIA®-ST(U-Varnish-S) on UPILEX-S And curing at max 400°C

Packing and handling precautions

(1) Packing example



(2) Handling precautions

- When handling "UPILEX®" at high temperatures attention should be paid to ventilation. This is because DMAC, which "UPILEX®" contains traces of, produces carbon monoxide at temperatures over 300°C and at high temperatures, in excess of 500°C, "UPILEX®" generates pyrolytic products. Ventilation should be adequate to ensure that concentrations of DMAC and carbon monoxide are kept to safe levels (10ppm and 100ppm). In addition, breathing safety equipment, such as organic gasmasks, should be used to prevent the inhalation of fumes.
- Please refer to Safety Data Sheet (SDS) before use.

(3) Content Statement

The content provided is based on materials, data and information currently available and no guarantee is given with regard to content, physical properties or hazardous and harmful effects. Furthermore, handling precautions relate to normal handling. In unique situations requiring special handling, please use safety measures appropriate for the application and process.

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