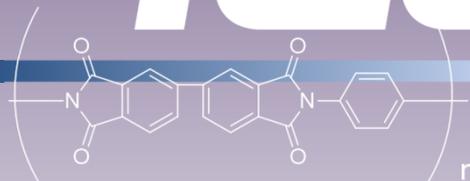


UBE



**UBE Polyimide Film
Exhibits Industry Leading
Heat Resistance**

UPILEX[®]



ユ-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.

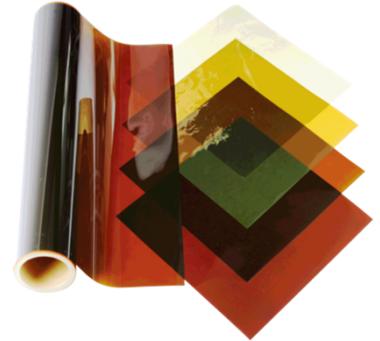
UBE Corporation

Advantages of "UPILEX®"

Heat-resistant and functional Polyimide film derived from BPDA

In addition to the excellent properties of general polyimide resins (heat resistance, high mechanical properties and excellent electrical insulating properties), UBE's polyimide film "UPILEX®" has various advantages unique to our formulation.

- High heat resistance---
"UPILEX®-S" can be used in high-temperature processes just below 500°C. This exceeds industry standard operating temperatures around 300°C.
- High mechanical properties---
Upilex has excellent wear resistance and toughness. This allows use of thinner films in applications where strength is critical.
- Chemical resistance---
It has excellent chemical resistance to organic solvents, gasoline, automotive oil, alkalis, acids etc..
- High-performance technology---
The industry leading surface uniformity and smoothness of "UPILEX®" improves performance and adds value to your application.



Grade lineup

UBE developed advanced film grades by customizing the base technology of the polyimide film surface, while maintaining the many advantages of the existing grade "UPILEX®-S". "UPILEX®" is used globally by many customers, who all demand the exceptional performance we deliver.

Base grade

UPILEX®-S

- **Mechanical properties:**
High tensile strength and modulus. Demonstrates outstanding mechanical characteristics through a wide temperature range.
- **Electrical properties:**
Excellent electrical characteristics over a wide range of temperatures and frequencies.

- **Thermal properties:**
Outstanding heat resistance. Excellent heat shrinkage and dimensional stability.
- **Environmental resistance:**
Low water absorption and hygroscopic expansion.
- **Chemical resistance:**
Insoluble in all organic solvents and resistant to chemicals (acids and alkalis etc.).
- **Smooth surface:**
Excellent surface smoothness allows fine pitch patterning.

Molding grade

UPILEX®-RN

- **Molding processability:**
Elongation over 100%. Excellent moldability for embossing due to better flexibility and lower modulus than "UPILEX®-S".
- **Environmental resistance:**
Molded articles have excellent heat resistance and chemical resistance, so they are used in insulation applications and in applications requiring environmental resistance.

Polyimide resin equivalent of UPILEX®-S

Function of the film surface

Enhanced thermal adhesion to metal

Surface thermal adhesion grade

UPILEX®-VT UPILEX®-NVT

As base films for laminated multilayer FPC and two-layer CCL, they have superior heat bonding characteristics and physical properties.

Enhanced adhesion of resin surface

Improved adhesion for sputtering, plating

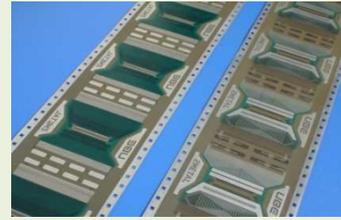
UPILEX®-SGA

It is suitable for sputtering or plating process and has superior mechanical properties. Dimensional stability and chemical resistance are equal to "UPILEX®-S".

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°C | -196°C | 25°C | 300°C | 25°C | 25°C | 200°C | 25°C | |
| 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 | Ω·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 ⁻³ 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 | ×10 ³ 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 |

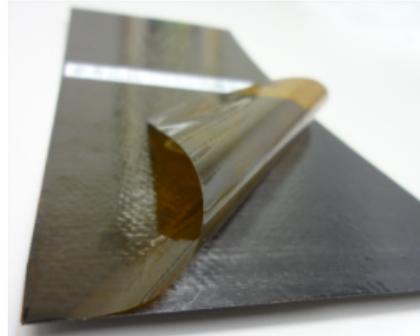
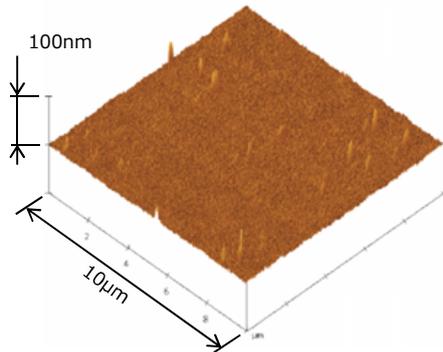
(6) Smooth surface

"UPILEX®-S" has an 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 ■ ■

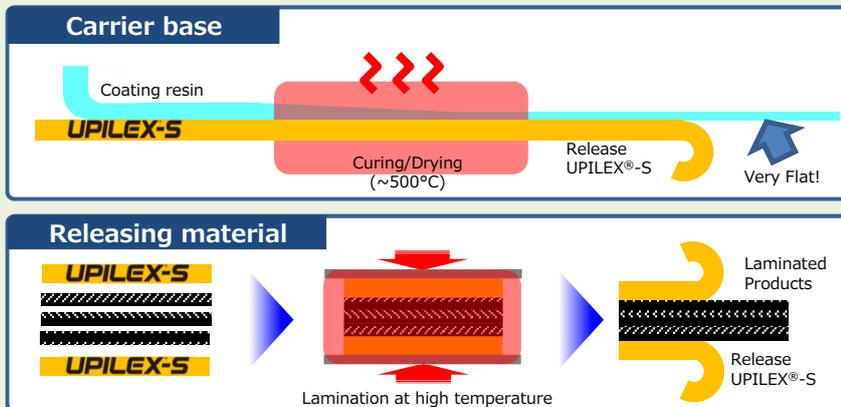
| Surface Roughness | Unit | Standard value | | | | General Polyimide | PET | Measurement method |
|-------------------|------|----------------|-------------|-------------|--------------|-------------------|-----|--------------------------------------------------------|
| | | UPILEX -25S | UPILEX -50S | 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" ■ ■

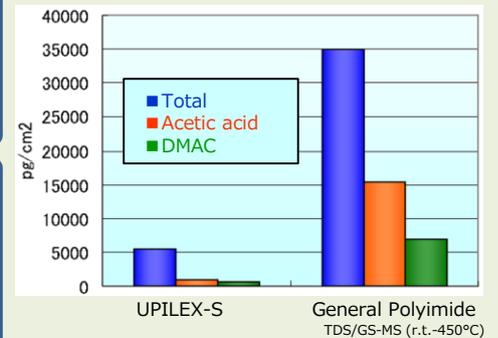


< Carrier base, Releasing material Application Examples >

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 |

Molding grade

UPILEX®-RN

“UPILEX®-RN” has many excellent physical characteristics, including molding process-ability and environmental resistance. Therefore “UPILEX®-RN” can be used in embossing, speaker diaphragms, aerospace applications, etc..

- “UPILEX®-RN” has excellent tolerance not only to acids and organic solvents, but also to alkalis.
- “UPILEX®-RN” has excellent heat resistance ,electrical properties, and radiation resistance.
- Since it has excellent elongation through heating and pressing, it is easy to make solid components using drawing process. Molded articles have excellent strength characteristics.
- “UPILEX®-RN” can form an excellent insulating layer by ribbon winding to a conductor such as a coil, due to it’s low modulus and high flexibility compared to “UPILEX®-S”.



■ ■ Grades and Area factor of “UPILEX®-RN” ■ ■

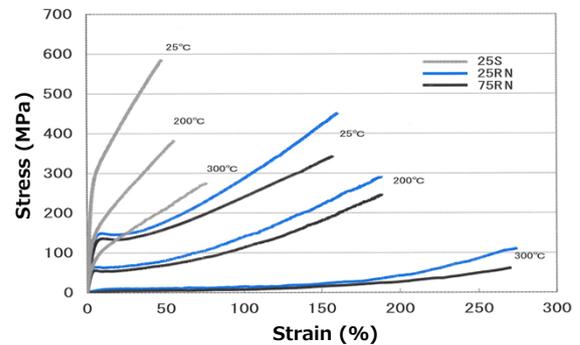
| Type | Grade | Thickness (μm) | Width* (mm) | Area factor (m ² /kg) |
|------------|-------|----------------|-------------|----------------------------------|
| UPILEX®-RN | 25RN | 25 | 508 | 28.8 |
| | 50RN | 50 | 508 | 14.4 |
| | 75RN | 75 | 508 | 9.6 |
| | 125RN | 125 | 508 | 5.8 |

*For custom widths, please contact us

(1) Mechanical properties

| Property | Unit | Standard value | | Measurement Method |
|------------------|------------------------------------|----------------|-------------|--------------------|
| | | UPILEX-25RN | UPILEX-75RN | |
| Tensile strength | MPa | 390 | 380 | ASTM D882 |
| Elongation | % | 160 | 150 | ASTM D882 |
| Tensile modulus | GPa | 3.9 | 3.9 | ASTM D882 |
| Density | ×10 ³ kg/m ³ | 1.39 | 1.39 | ASTM D-1505-03 |

■ ■ Stress-Strain Curve of “UPILEX®-RN” ■ ■



(2) Electrical properties

| Property | Unit | Standard value | | Measurement condition | Measurement Method |
|---------------------|------|-------------------|-------------------|-----------------------|--------------------|
| | | UPILEX-25RN | UPILEX-75RN | | |
| Dielectric strength | kV | 7.1 | 13.9 | 60Hz | ASTM D149 |
| Dielectric constant | - | 3.4 | 3.5 | 1MHz | ASTM D150 |
| Dissipation factor | - | 0.007 | 0.007 | 1MHz | ASTM D150 |
| Volume resistivity | Ω·m | >10 ¹⁴ | >10 ¹⁴ | DC 100V | ASTM D257 |
| Surface resistivity | Ω | >10 ¹⁵ | >10 ¹⁶ | DC 100V | ASTM D257 |

(3) Thermal properties

| Property | Unit | Standard value | | Measurement condition | Measurement Method |
|------------------------------|------|----------------|-------------|-----------------------|--------------------------|
| | | UPILEX-25RN | UPILEX-75RN | | |
| Heat life (Tensile strength) | °C | 270 | 270 | 20,000h | Fixed temperature method |
| Flammability | - | V-0 | V-0 | - | UL94 |

(4) Chemical property

| Property | Unit | Standard value | | Measurement Method |
|------------------|------|----------------|-------------|--------------------|
| | | UPILEX-25RN | UPILEX-75RN | |
| Water Absorption | % | 1.4 | 1.7 | ASTM D570 |

Surface thermal adhesion grade

UPILEX®-VT UPILEX®-NVT



“UPILEX®-VT” and “UPILEX®-NVT” are heat bonding polyimide films having heat fusing layers on both side of the film, created by the polyimide resin equivalent of “UPILEX®-S”.

High quality flexible circuits without an adhesive layer are obtained, by heating and pressing “UPILEX®-VT” or “UPILEX®-NVT” with metal (Cu, SUS, Al) foil.

In addition, they are also available for bonding films comprised of metal, ceramic and other materials.

- Flexible circuits without adhesive are produced.
- This offers high tensile strength and tear strength.
- Offering the same low water absorption, low dimensional change and high heat resistance as “UPILEX®-S”, with the addition of laminate workability in the heat press.



Grades and Area factor of “UPILEX®-VT, NVT”

| Type | Grade | Thickness (μm) | Width* (mm) | Area factor (m ² /kg) |
|-------------|---------|----------------|-------------|----------------------------------|
| UPILEX®-VT | 12.5VT | 13 | 510, 520 | 57.1 |
| | 20VT | 20 | 510, 520 | 35.1 |
| | 25VT | 25 | 510, 520 | 28.0 |
| | 50VT | 50 | 510, 520 | 13.9 |
| UPILEX®-NVT | 12.5NVT | 13 | 510, 520 | 55.1 |
| | 20NVT | 20 | 510, 520 | 35.5 |
| | 25NVT | 25 | 510, 520 | 28.4 |
| | 50NVT | 50 | 510, 520 | 14.0 |

*For custom widths, please contact us.

(1) Mechanical properties

| Property | Unit | Standard value | | Measurement Method |
|------------------|------------------------------------|----------------|-------------|---------------------|
| | | UPILEX-25VT | UPILEX-50VT | |
| Tensile strength | MPa | 530 | 540 | ASTM D882 |
| Tear strength | N/mm | 3.0 | 4.3 | IPC-TM-650 2.4.17.1 |
| Elongation | % | 90 | 90 | ASTM D882 |
| Tensile modulus | GPa | 7.5 | 7.6 | ASTM D882 |
| Density | ×10 ³ kg/m ³ | 1.43 | 1.44 | ASTM D-1505-03 |

(2) Electrical properties

| Property | Unit | Standard value | | Measurement condition | Measurement Method |
|---------------------|------|-------------------|-------------------|-----------------------|-------------------------|
| | | UPILEX-25VT | UPILEX-50VT | | |
| Dielectric strength | kV | 7.2 | 10.5 | 60Hz | ASTM D149 |
| Dielectric constant | - | 3.2 | 3.3 | 1GHz | Triplate-Line Resonator |
| | | 3.2 | 3.3 | 10GHz | Triplate-Line Resonator |
| Dissipation factor | - | 0.005 | 0.004 | 1GHz | Triplate-Line Resonator |
| | | 0.007 | 0.007 | 10GHz | Triplate-Line Resonator |
| Volume resistivity | Ω·m | >10 ¹⁴ | >10 ¹⁴ | DC 100V | ASTM D257 |
| Surface resistivity | Ω | >10 ¹⁵ | >10 ¹⁵ | DC 100V | ASTM D257 |

(3) Thermal properties

| Property | Unit | Standard value | | Measurement condition | Measurement Method |
|-------------------------------------------------|--------|----------------|-------------|-----------------------|-------------------------|
| | | UPILEX-25VT | UPILEX-50VT | | |
| Thermal linear expansion coefficient (50-300°C) | ppm/°C | 20 | 20 | - | Fine linear dilatometer |
| Heat shrinkage | % | 0.31 | 0.35 | 300°C, 2h | JIS C2318 |
| Thermal decomposition temp. at 5% weight loss | °C | 584 | 582 | In Air | TG-DTA |
| Flammability | - | V-0 | V-0 | - | UL94 |

(4) Chemical properties

| Property | Unit | Standard value | | Measurement Method |
|---------------------|---------|----------------|-------------|--------------------|
| | | UPILEX-25VT | UPILEX-50VT | |
| Water absorption | % | 1.1 | 1.4 | ASTM D570 |
| Moisture Absorption | ppm/%RH | 14 | 13 | UBE method |

Improved adhesion for sputtering, plating

UPILEX®-SGA



“UPILEX®-SGA” is a polyimide film having improved adhesion properties created by a special process to both sides of the “UPILEX®-S”. It is suitable for sputtering or plating processes because of high surface adhesion. It offers a flexible base for high-performance electronic circuits. In addition, it can also be used as an adhesive tape base material for LOC packaging.

- In sputtering or plating, a flexible base for electronic circuits that does not use any adhesives can be obtained.
- Peel strength is high, surface smoothness is very high.
- Superior mechanical property, with low water absorption, excellent dimensional stability and high heat resistance comparable to “UPILEX®-S”.



■ ■ Grades and Area factor of “UPILEX®-SGA” ■ ■

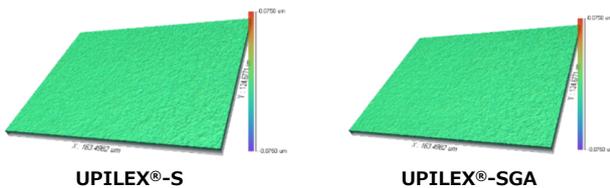
| Type | Grade | Thickness (μm) | Width* (mm) | Area factor (m ² /kg) |
|-------------|-------|----------------|-------------|----------------------------------|
| UPILEX®-SGA | 25SGA | 25 | 508 | 27.2 |
| | 50SGA | 50 | 508 | 13.6 |

*For custom widths, please contact us

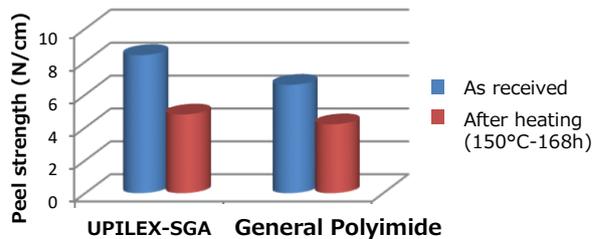
(1) Mechanical properties

| Property | Unit | Standard value | | Measurement Method |
|------------------|------------------------------------|----------------|--------------|--------------------|
| | | UPILEX-25SGA | UPILEX-50SGA | |
| Tensile strength | MPa | 490 | 490 | ASTM D882 |
| Elongation | % | 40 | 45 | ASTM D882 |
| Tensile modulus | GPa | 10 | 9.7 | ASTM D882 |
| Density | ×10 ³ kg/m ³ | 1.47 | 1.47 | ASTM D-1505 |

■ ■ Surface morphology of “UPILEX®” ■ ■



■ ■ Peel strength of “UPILEX®-SGA” ■ ■



(2) Electrical properties

| Property | Unit | Standard value | | Measurement condition | Measurement Method |
|---------------------|------|-------------------|-------------------|-----------------------|--------------------|
| | | UPILEX-25SGA | UPILEX-50SGA | | |
| Dielectric strength | kV | 6.4 | 10.6 | 60Hz | ASTM D149 |
| Dielectric constant | - | 3.4 | - | 1GHz | IPC-TM650 2.5.5.9 |
| Dissipation factor | - | 0.003 | - | 1GHz | IPC-TM650 2.5.5.9 |
| Volume resistivity | Ω·m | >10 ¹⁴ | >10 ¹⁴ | DC 100V | ASTM D257 |
| Surface resistivity | Ω | >10 ¹⁶ | >10 ¹⁶ | DC 100V | ASTM D257 |

(3) Thermal properties

| Property | Unit | Standard value | | Measurement condition | Measurement Method |
|-------------------------------------------------|--------|----------------|--------------|-----------------------|-------------------------|
| | | UPILEX-25SGA | UPILEX-50SGA | | |
| Thermal linear expansion coefficient (50-200°C) | ppm/°C | 13 | 14 | - | Fine linear dilatometer |
| Heat shrinkage | % | 0.06 | 0.06 | 200°C, 2h | ASTM D1204 |

(4) Chemical property

| Property | Unit | Standard value | | Measurement Method |
|------------------|------|----------------|--------------|--------------------|
| | | UPILEX-25SGA | UPILEX-50SGA | |
| Water absorption | % | 1.2 | 1.4 | ASTM D570 |

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 gas masks, 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.



**Polyimide Business
Department**

Seavans North Bldg, 1-2-1, Shibaura, Minato-Ku, Tokyo, Japan, 105-8449

TEL : +81(3)5419-6180

FAX : +81(3)5419-6258

<URL> <https://www.ube.com/upilex/en/>