SABIC
Innovative
Plastics™

Specialty Film & Sheet

High performance in harsh environments

Flame retardant materials for the electronics and electrical industries

Sharing our futures

Global solutions from Specialty Film & Sheet provide value-added solutions across a wide variety of industries, ranging from electronics and electrical to transportation and graphics. These solutions are founded on a portfolio of high quality materials backed by advanced technical support around the world.

As a business unit of SABIC, SABIC Innovative Plastics benefits from global cross-business resources and expertise. The Polymer Processing Development Center in the USA and its satellite centers around the world help to keep customers at the leading edge of film and processing technology.

Hands-on engineering support for customers covers the numerous aspects of application development – from design reviews, prototyping and testing, to thermoforming, injection molding and in-mold decoration (IMD).

Bar code labels utilizing Ultem* 1000B film by Polyonics Inc., Westmoreland, NH, USA. polyonics.com

Valox*, Lexan* and Ultem* films

Innovation from a single source

SABIC Innovative Plastics offers the electronics and electrical industries a portfolio of film and sheet products that is founded on the highest quality polymer technology.

Valox, Lexan and Ultem films can be excellent candidates to help deliver innovative design solutions that are founded upon cost-effective fabrication and high performance in harsh environments. From simple flat barrier insulation to highly complex, three-dimensional EMI/RFI shielding, these films provide the right balance of flame retardant, electrical and thermal properties, without the use of secondary operations.

In line with growing demand for component miniaturization, molding with increasingly thinner walls and ever more complex parts, these state-of-the-art engineering materials continue to evolve to help meet increasingly tougher requirements for thermal and electrical performance and ease of fabrication.

Low flammability

The flame-retardant products in this brochure are characterized by both exceptionally good flame resistance, according to Underwriters' Laboratories (UL 94) and excellent heat stability.

(For a complete list of the most recent UL Listings, please contact SABIC Innovative Plastics or consult UL File #E61257).

Excellent dielectric properties

With their excellent electrical insulating properties, these materials provide parts with long-term operating reliability over widely fluctuating ranges of temperature, pressure and frequency.

Ultem film grades exhibit a very stable dielectric constant of 3.0 over a frequency range of 1 GHz - 10 Ghz.

High mechanical strength

Due to their inherent impact strength and practical toughness, these materials have a proven track record in a wide range of demanding applications in which tear strength and puncture resistance are critical.

Excellent printability

Unlike competitive insulating materials, SABIC Innovative Plastics film and sheet products are easily printed with part I.D. numbers or safety standard warnings (usually before die-cutting), often eliminating the need for secondary labelling.

Easy, cost-effective fabrication

All film and sheet grades are easily fabricated and bonded using standard tooling and fabrication methods. 3D shapes, snap-fits and locator tabs can be simply incorporated to effect part consolidation and possible cost savings. These products can be thermoformed, scored, cold-embossed or die-cut with high precision. Gauge control across the web is excellent, thereby preventing the risk of damage to the die from uneven material thickness.

Compatibility with adhesives

Easy processing is complemented by compatibility with a broad range of fastening and laminating adhesives, including silicone rubbers, epoxies and acrylics.

Recyclability

These high performance film materials, in many cases can be recycled and they comply with the requirements of RoHS Directive 2002/95/EC, TC099 and ECO label. In addition, flame retardant Ultem film complies with ECO regulation with its bromide-free formulation.

Shielding
Lexan* FR film and Ultem* 1000B film
U.S. and European agencies continue to tighten regulations on EMI/RFI emissions. Effective shielding solutions include metal boxes, conductive paints, plating, metal chassis and conductive polymers. However, these methods add significant cost and unwanted weight to electronic devices.

Specialty films from SABIC Innovative Plastics may offer a low-cost, lightweight solution to both primary shielding and secondary (problem area) shielding, while maintaining UL recognition. Laminated to a conductive foil, such as copper or aluminium, these high performance insulating films may be excellent candidates for allowing creatively designed shields to be placed in close proximity to the emitting source, without fear of internal arcing.

Die-cut insulators and spacers
Lexan FR film and Ultem 1000B film
FR films from SABIC Innovative Plastics are commonly used for die-cut insulators and spacers in a wide range of electrical applications. Good temperature resistance, chemical resistance and processability are its typical material properties, as well as ease of fabrication and compatibility with many fastening and laminating adhesives. The films can be easily thermoformed into complex, three-dimensional parts or cold-formed.

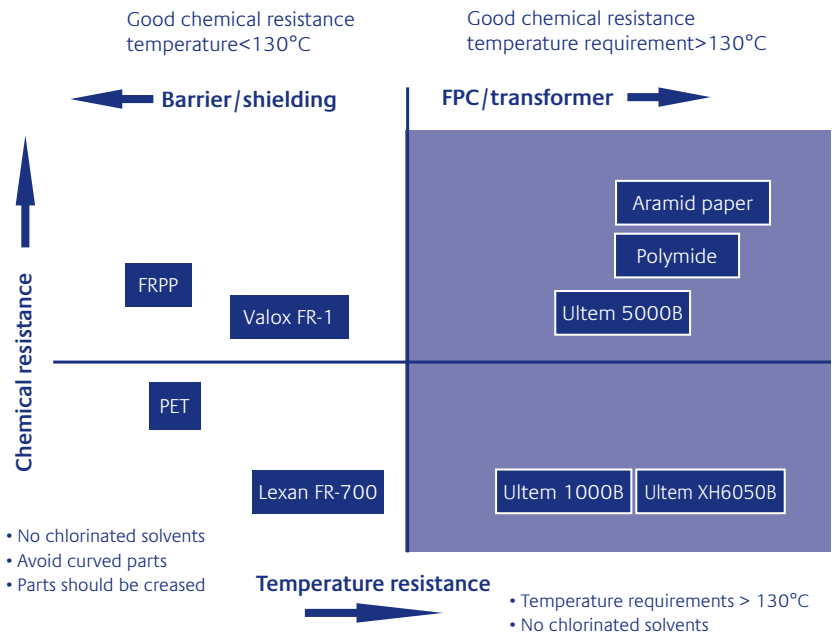
Insulation barriers
Lexan FR 700, 60 films and Ultem 1000B film
Size and weight reductions are key concerns in power supply design. Furthermore, high voltage arenas such as power supplies are closely monitored by world agencies like UL. Flame retarded films from SABIC Innovative Plastics may be excellent candidates for providing excellent thermal and electrical insulation properties. They also offer important opportunities for weight and size reduction while maintaining UL recognition.

Labels and overlays
Lexan FR, Valox* FR1 films and Ultem 1000B Film
These films may find use in a wide range of labels, nameplates and overlays, which require high temperature resistance, excellent electrical properties and compatibility with both UV-curing and conventional inks.

Printed circuits
Lexan FR film and Ultem 1000B film
A combination of low moisture absorption, high temperature resistance and resistance to a broad range of organic solvents and chemical detergents makes these films a popular choice for printed circuit board applications. These films are resistant to the chemicals used in PCB manufacture as well as the most commonly used automotive and aircraft fluids.

Figure 1 - dielectric strength vs. thickness (typical values in volts)

Thickness (mills)	Ultem film	Valox film	Lexan film
1	—	—	—
2	6,450	—	—
3	8,100	7,550	9,350
4	9,500	9,000	10,800
5	10,800	10,300	12,100
7	13,050	12,600	14,300
10	—	15,650	17,100
15	—	20,050	21,000
20	—	23,850	24,200
25	—	27,300	27,050
30	—	30,500	29,650



Comparison of UL recognition

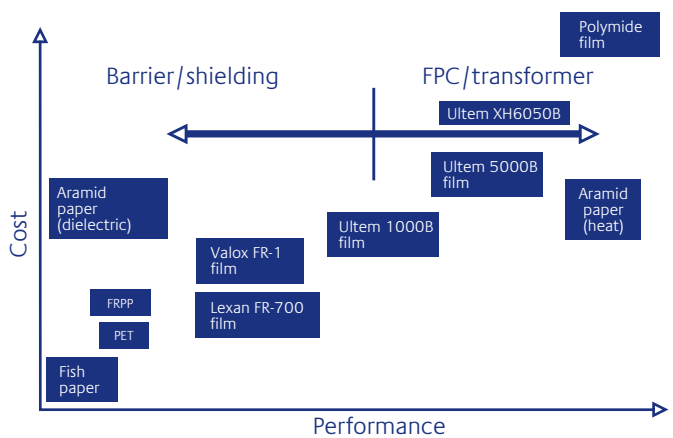
Figure 2 - comparison of UL recognition

	Thickness UL-94		Thermal index		Performance criteria		
Product	inches	mm	Flame rating	Electrical	HWI	HAI	CTI
Lexan* FR-700 film	.010	.254	VTM-0	130	1	0	3
Lexan FR-700 film	.015	.380	V-0	130	0	0	3
Lexan FR-700 film	.030	.760	V-0	130	0	0	3
Lexan FR-83 film	.003	.076	VTM-0	80	—	—	3
Ultem* 1000B film	.002	.050	VTM-0	150	—	—	—
Ultem 5000B film	.002	.050	VTM-0	150	—	—	—
Valox* FR-1 film	.005	.127	VTM-0	125	—	—	2
Valox FR-1 film	.010	.254	VTM-0	125	4	0	2
FRPP	.016 min	.410 max	VTM-0	100	4	3	0
FR-PET	.05 max	.127 max	VTM-2	105	5	0	1
FR fiberboard	.015 min	.380 min	V-0	90	3	0	3
ARAMID paper	.010	.254	V-0	220	0	—	3
Fish paper	.032	.810	HB	115	—	—	0
G-10	.025	.640	none	130	4	4	—

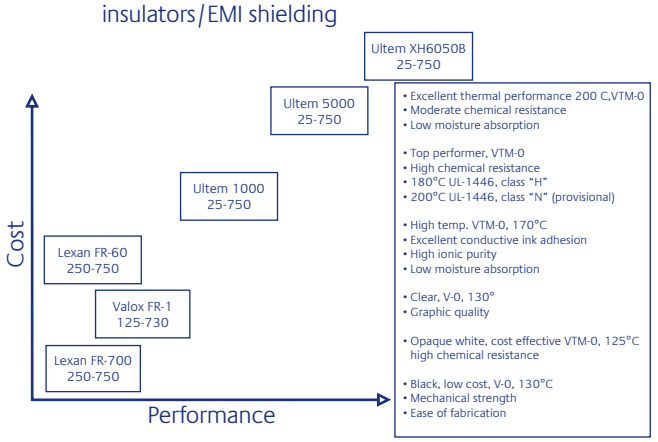
Figure 3 - insulating films - typical property comparison

Material	Tensile strength (psi) ASTM D-882	Ultimate elongation (%) ASTM D-882	Initiation tear strength (g/mi) ASTM D-1004	Moisture absorbtion (%) ASTM D-570	Dielectric constant @ 1 KHz ASTM D-150	Dielectric strength @ 1 mil (V/mil) ASTM D-149	Dissipation factor @1 KHz ASTM D-150	Flammability UL94†	Heat distortion temperature °C ASTM D-1637
Valox FR-1 film	6,500	80-150	649	0,4	3.26	5,000	0.004	VTM-0 5 mil V-0 25 mil	227
Lexan FR-700 film	8,800	25-50	908	0.28	2.8	7,000	0.003	VTM-0 10 mil V-0 15 mil	167
Lexan FR-83 film	8,800	25-50	908	0.28	2.8	7,000	0.003	VTM-0 3 mil	150
Lexan FR-60 film	8,800	25-50	908	0.28	2.8	7,000	0.003	VTM-0 10 mil V-0 5 mil	N/A
Flame resistant Aramid paper	11,000	13-17	500	5.0	3.0	435 @ 2 mil	0.004	V-0 5 mil	249
Ultem 1000B film	14,650	60	-	0.48	3.2	5,000	0.005	VTM-0 2 mil	
Ultem 5000B film	12,475	45	-	0.33	3.3	5,300	0.006	VTM-0 2 mil	
Polyimide film HN	33,500	72	729	2.8	3.5	7,000	0.002	V-0 0.3 mil	N/A
FR-PP	4,800	100	600	0.01	2.3	1,720	0.003	VTM-0 10 mil V-0 18 mil	166

This rating is not intended to reflect hazards presented by this or any other material under actual fire conditions



SABIC Innovative Plastics product portfolio for insulators/EMI shielding



Lexan* FR film

Clear or opaque Lexan FR film is a flame retardant polycarbonate material, which is renowned for its consistent properties. These include puncture resistance, low moisture absorption, high thermal performance and excellent dielectric strength. It is available in a variety of surface textures and offers reliable ease of fabrication. With its formability and high dimensional stability at high temperatures, Lexan FR film is an excellent candidate for barrier insulation applications. These include insulation for high voltage power supplies, disc drives, flat panel displays, printed circuit boards and keyboards. It also acts as an excellent carrier for foil-based EMI/RFI shields.

Lexan FR-6x film (PCB insulation)
- Optically clear
- Meets UL94 V-0
- Good HWI, HAI, CTI performance
- Meets UL-1950, IEC950
- Gauge range: 0.010-0.030" (0.25-0.75 mm)
- Available widths: 36" and 48" (915mm and 1220 mm) 60" (1525 mm) available for select products

Lexan FR-83 film (Power supply insulation)
- Optically clear/black
- Meets UL94 VTM-0
- Thin gauge (50 microns)
- Value-added high performance
- Gauge range: 0.002-0.007" (0.05-0.175 mm)
- Available widths: 36" (915 mm)

Parts utilizing Lexan FR films by Marian Fort Worth, Cut Craft Division, USA. marianinc.com

Lexan FR700 film (Copper foil-laminated digital shielding)
- Opaque black
- Meets UL94 V-0
- Meets UL-1950, IEC 950
- Good HWI, HAI, CTI performance
- Dielectric strength of 17,000 volts at 250 microns
- Gauge range: 0.010-0.030" (0.25-0.75 mm)
- Available widths: 36" and 48" (915mm and 1220 mm)

Lexan FR25A film (PCB insulation)
- Opaque black, white, light gray and dark gray
- Meets UL94V-0, UL-1950 and IEC 950
- Good HWI, HAI and CTI performance
- Good fold endurance with score and bend fabrication
- Gauge range: 0.010 - 0.030" (0.25-0.75 mm)
- Available widths: 30 to 48 inch (762 to 1220 mm)

Valox* FR film

Valox FR film is a flame retarded polybutylene terephthalate material offering good temperature resistance and excellent dielectric strength. This material has found use in a wide range of applications in the electronics industry, including disc drive insulation and other business equipment components requiring barrier insulation. With its low moisture absorption and excellent chemical resistance, it is commonly used for laminated EMI/RFI shields.

Valox FR-1 film (overlays)
- Opaque white and black
- Meets UL94 V-0 at 25 mils
- Meets UL94 VTM-0 at 5 mils
- Meets UL-1950, IEC 950
- Superior HWI, HAI, CTI performance
- Puncture resistance
- High dimensional stability
- Gauge range: 0.003-0.030" (0.075-0.75 mm)
- Available widths: 36" and 48" (915mm and 1220 mm)

Ultem* FR film

Ultem film is a polyetherimide thermoplastic material with high ionic purity. This high modulus, low density amorphous material is the highest performance film in SABIC Innovative Plastics' portfolio, offering enhanced heat and chemical resistance. The combination of Class H high temperature resistance, low moisture absorption and excellent dielectric properties make it a popular choice for high-voltage internal insulation, high-temperature PSA tapes, speaker cones, motor-slot liners and wedges and transformer wraps.

The latest generation family of Ultem films, based on the company's patented X Gen* resin technology, pushes engineering film performance to even greater heights. These pioneering films were specifically developed to offer a value-added combination of long-term high heat performance and electrical properties. Depending upon the substrate, they can be heat sealed to a variety of materials like polyimide films and LCP films without the use of adhesives.

Ultem 1000B film
(FDA approved application)
- Meets UL 94 V-0 at 2 mils
- 217°C Tg
- Excellent thermoforming
- Superb metal adhesion
- Available in natural and black colors

Ultem 5000B film
(high temperature PSA tapes)
- Meets UL94 V-0 at 2 mils
- 229°C Tg
- Outstanding chemical resistance
- Good metal adhesion
- Superb dielectric strength (5300 volts/mil)
- Available in natural and black colors

Ultem XH6050B film
- X Gen resin technology
- Highest temperature performance in range (245°C Tg)
- Excellent thermoforming
- Heat sealable to variety of materials

Global application development

SABIC Innovative Plastics offers customers around the world with easy access to a full range of laboratory, testing and design services complemented by local hands-on technical support, with dedicated in-house facilities for printing, forming, molding and prototype testing, supported by pioneering materials and technology expertise.

The company offers comprehensive support on
- The right combination of films, resins and inks
- Design and tooling considerations
- Processing recommendations

With satellite development centers in the Netherlands, Japan, China, India and USA, SABIC Innovative Plastics, Specialty Film & Sheet serves customers around the world in a broad spectrum of industries and applications. These include aircraft, appliances, automotive, building and construction, business machines, electrical and lighting, furnishing, greenhouse, industrial roofing, medical, electronics, telecommunications and packaging.

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