安固高科
ANGLE-TECH

ANHUI ANGLE TECHNOLOGY CO.LTD

ANGLE-TECH

TPU . SGP . PVB R&D, PRODUCTION AND MANUFACTURING

Factory address : No.1 Liyuan Avenue, Beicheng New District, Bengbu City, Anhui China Province

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High strength | Low temperature resistance
Penetration resistance | Aging resistance

安固高科
ANGLE-TECH

Join hands to create
a technological future

01
COMPANY PORFILE

2016
Established In Bengbu

3 Items
International Standard
Production Line

10 Multiple
Invention Patent

Anhui Angle Hi-Tech Co, LTD is an innovative technology company dedicated to improving the glass comprehensive performance. The company was founded in 2016, the factory is located in Bengbu city of Anhui Province. The company brings together R&D, production and sales, to provide domestic and foreign customers with scarce high-quality polymer advanced materials.
The main products are divided into four series :

- TPU Film
- SGP High Strength Ionic Interlayer Film
- XIR Ultra-Energy Saving Film
- PVB/EVA Film

Company Qualification:High-Tech Enterprises in Anhui Province, More Than 30 Patents,GB/19001-2016/ ISO9001:2015 International Quality System Certification,ISO 14001:2004 Environmental Management System Certification,TUV NORD Certification,SGS Certification (Environmental Certification),Military Qualification Certification (Environmental Certification)Military Qualification Certification.After years of development, the company has established a mature research and development productionbase. Currently, the company covers an area of 32 acres.The company has three international first class production lines, including one aviation and military standard ultra wide TPU bulletproof film production line, one ultra wide SGP Ionic intermediate film production line, and one XIR/PVB ultra energy saving multifunctional film production line.The company's products are sold to over 30 countries and regions with excellent performance and good reputation, and have established long-term and stable cooperative relationships with numerous well-known domestic and foreign enterprises.The company actively participated in the preparation of national industry standards such as the National Standard for laminated glass, and the General technology Specification for Aerospace Thermoplastic Polyurethane Elastomer Intermediate Film.

The company's products are exported to more than 30 countries and regions with their excellent performance and good reputation, and have established long-term and stable cooperative relationships with many well-known domestic and foreign enterprises. Especially in the field of TPU bulletproof film and SGP ionic type intermediate film, it has broken the foreign monopoly and achieved localization. At present, we have established good cooperative relationships with many domestic military factories and aerospace enterprises. Our company has obtained national standard GB/19001-2016 certification, ISO9001:2015 quality system certification, EU CE certification, US SGCC certification, and national military standard GJB9001C: 2017 system certification, as well as weapon and equipment manufacturing certificate and confidentiality certificate, to achieve the goal of joining the civilian army. Against the backdrop of the country's strong advocacy for military civilian integration, actively responding to national strategies and contributing to the national defense cause is our noble mission!

02
COMPANY PORFILE

03

TPU BULLETPROOF FILM

TPU film is mainly composed of polyurethane elastomer, which is made by special process. Widely used in armor, aircraft, automobiles, informationtechnology, new energy, high-end equipment and other fields.

Maximum Width That Can Be Produced: 2800mm

Product specifications (coil)

Thickness	Width	Length
0.38mm	800mm-2800mm	100m
0.63mm	800mm-2800mm	100m
1.27mm	800mm-2800mm	50m

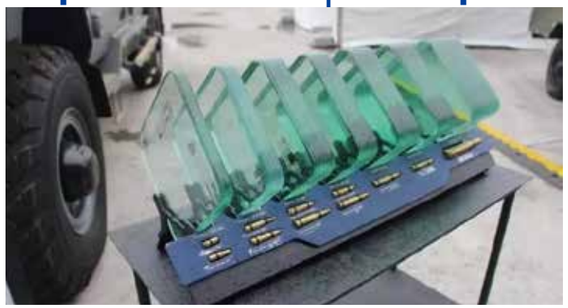
Note: Non-standard size can be customized.

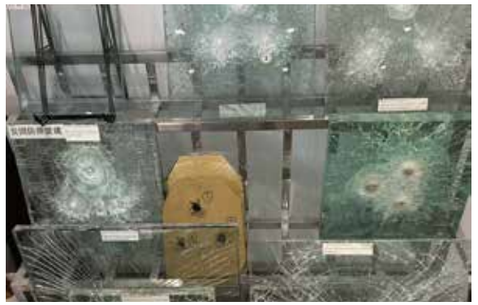
Technical Parameter

Items	Test result	Testing standards
Shore hardness	75A	ASTMD2240
Density	1.06g/cm^3	ASTMD792
Transmittance	91.7%	ASTMD1003
Haze	0.16%	ASTMD1003
Tensile strength	45MPa	ASTMD638
Tear strength	72.5KN/M	ASTMD1004
Elongation at break	530%	ASTMD638
Peeling Strength	18.6KN/M	ASTMDD3330M
Glass transition temperature	-60°C	ASTMDD3418
Yellowing index	0.2	ASTMDE313

TPU APPLICATION

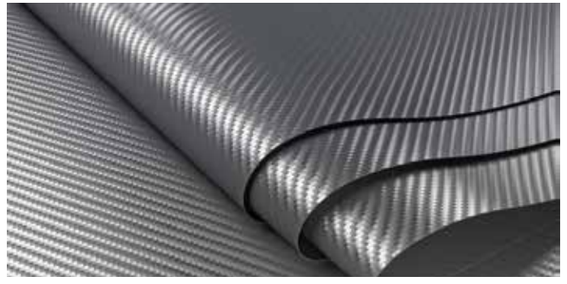
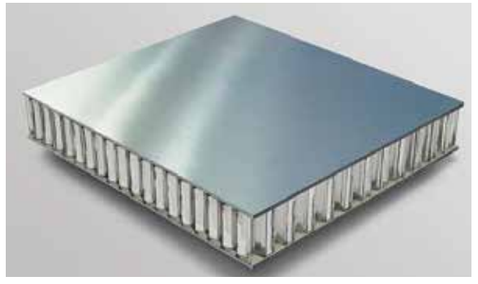
Explosion Proof | Bulletproof



Composite Materials



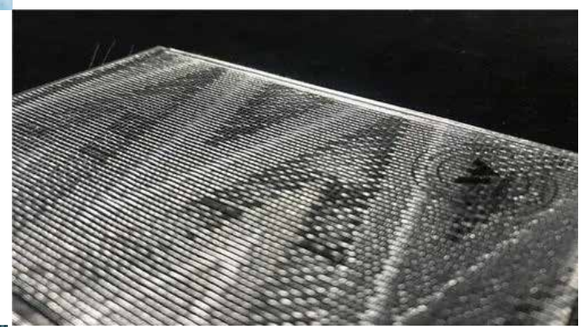
TPU Film Characteristics

Low temperature resistance

Low temperature resistance
The performance remains unchanged in the extreme low temperature environment of minus 60°C.

It can bond different materials

TPU laminated film not only has superior adhesion with inorganic glass and ceramics, but also has excellent adhesion performance with organic materials such as PC board, PMMA (acrylic), PET etc. It is an excellent choice for making composite bullet proof glass and shatterproof glass.



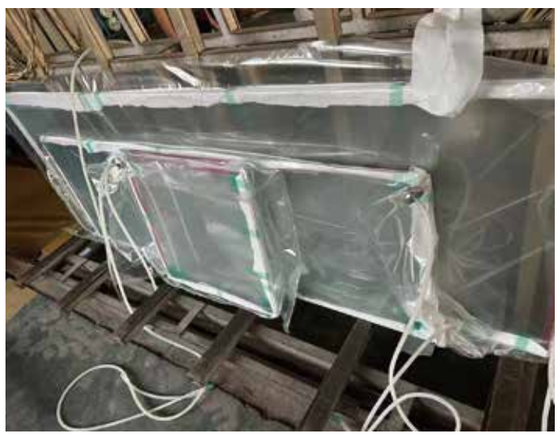
Excellent aging resistance

TPU has good weather resistance, anti-yellowing performance and is not easy to aging, not sensitive to water and other chemicals, no need for edge sealing.

Excellent Resistance to penetration

TPU itself has good toughness and impact resistance.Using it to make laminated glass can improve the antiriot and bullet proof functions of the glass. It is the best choice for making high-grade bullet proof vest.

PROCESSING AND FORMING TECHNOLOGY



Laminated Glass

- 1.Clear-Room:
  The temperature standard: 20°C-25°C;
  The humidity: 23% +2%;The room should be dust-free;
  The machines should be clean.The operators must wear uniforms, hats, gloves and keep neat.

- 2. Lay-up sandwich conditions:
  The surface temp of the glass: 20°C-30°C (the max 40°C) ;Film surface temperature: 20°C-25°C;The film and glass are clean and accurately placed.

Vacuum Extraction And Exhaust

- Pressing Section Cold and hot extraction.
  Cold extraction:
  temperature 20°C-25°C, pressure -0.095Mpa-0.1Mpa. The continuous vacuum pumping time is about 20 minutes, and if the vacuum is not continuous, the cold pumping time is about30 minutes.
  Heating extraction:
  The surface temperature of the glass is 100°C-120°C, the time is 30-45 minutes, and the pressure is between -0.095Mpa-0.1Mpa. Remove the glass when cooled to 45°C-60°C.

Rolling Exhaust

- Preheating of constant temperature box → Surface temperature of laminated glass 20 °C-30 °C, humidity around 25% → Zone 1 constant temperature box 100 °C -120 °C, first preloading, pressure between 0.2Mpa-0.5Mpa, roller spacing less than about 1mm of total glass thickness → Zone 2 constant temperature box 160°C-180°C → Zone 3 constant temperature box 220°C -240°C → Second roller pressing,pressure 0.3MPa-0.5MPa, roller spacing less than about 2mm of the total glass thickness. Maintain continuous operation to maintain the temperature of the constant temperature chamber.

Autoclave Process

- The whole process should be slowly working in heating, pressure,cooling and depressurized.The following process can be used as a reference: Rising temperature and pressure increase →Temperature reach to 60 °C, Pressure is 0.4Mpa →Temperature reach to 90°C,Pressure is 0.8Mpa →Temperature reach to 120°C-130°C, Pressure is 1.0Mpa →Pressure reach to 1.1Mpa-1.3Mpa →Constant temperaturef or 30-60 minutes (depending on the thickness and quantity of glass in autoclave) → Constant pressure in cooling, naturally slowly cooling to 90°C → Exhaust when temperature falls to 45°C-55°C.

TPU APPLICATION

High Speed Rail Front Windshield Project

Using our company's 1.27mm TPU composite PC board, it meets the requirements of high-speed rail collision tests and has been widely applied in high-speed trains with a speed of 350 kilometers per hour.

Large Aircraft window glass project

High-speed Trains and Aircraft TPU film provided by our company, perfect through the bird impact test, extreme low temperature impact test.

Chow Tai Fook Anti Smashing Glass

Adopt our 0.63mmTPU composite PC board, anti - smash grade reached C.

Armored vehicle bulletproof glass project

Using our company's TPU composite PC board, the bulletproof level reaches FJ79B, and the weight and thickness are only half of traditional bulletproof glass.

TPU FILM PRODUCTS ADVANTAGES

- The product quality has passed the national military standard GJB9001C: 2017 certification, and has been included in the China Ordnance Industry Group's qualified supplier, China Building Materials Inspection and Certification, ISO quality system certification, and SGS certification.
- Achieve technological innovation in super-wide TPU films, the maximum width can reach 2800mm.
- The delivery cycle is considerably shortened, delivering within 7-15 days.
- Break the foreign technological blockade, achieve a complete breakthrough from raw materials to production, and achieve progress in the military industry from 0 to 1.

04

SGP IONIC INTERLAYER FILM

SGP interlayer film is a new type of polymer material with high molecular weight and high elastic modulus, which is bonded by ion bonds.

Maximum Width That Can Be Produced: 4300mm

Product specifications (coil)

Thickness	Width	Length
0.38mm	800mm-4300mm	400m
0.76mm	800mm-4300mm	200m
0.89mm	800mm-4300mm	200m
1.14mm	800mm-4300mm	150m
1.52mm	800mm-4300mm	100m

Note: Non-standard size can be customized.

Comparison of Performance between SGP Film and Ordinary PVB Film

Property	SGP	PVB	Testing standards
Specific gravity g/cm	0.95	1.066	GB/T1033.1-2008
Tensile strength MPa	34.5	28.1	GB/T1040.1-2018
Tear strength KN/M	＞120	10-20	GB/T1040.3-2006
Elongation at Break	400%	275%	GB/T1040.1-2018
Haze	＜1%	2%	GB/T2680
Yellow Index	＜1.5	6-12	GB/T2680
Refractive Index	1.5	1.47-1.5	GB/T2680
Transmittance	89%	89%	GB/T2680
Moisture Content	＜0.2%	0.35%-0.65%	National standard for ion type intermediate membrane
Tack Value of Adhesive Force	⩾7	⩾6	GB/32020-2015
Residual Strength After Failurex	＜10.0cm	/	National standard for ion type intermediate membrane

SGP APPLICATION

Exterior curtain wall of building: Point installation of exterior curtain wall, glass ceiling, glass floor, glass railing.

Safety protective glass: hurricane resistant glass, explosion-proof glass, and anti violent intrusion glass.

Projects that emphasize the transparency effect of glass, such as multi-layer composite laminated glass or areas using ultra white glass.

Possible applications in automotive sunroofs, high-speed trains, aviation, and maritime fields.

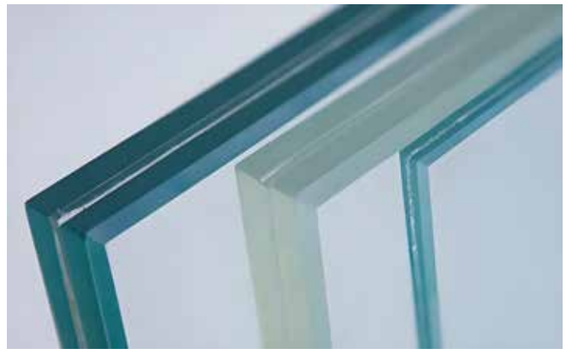
Oversized architectural glass.

Metal composite glass

Product Advantages And Features

Has High Strength And Shear Modulus

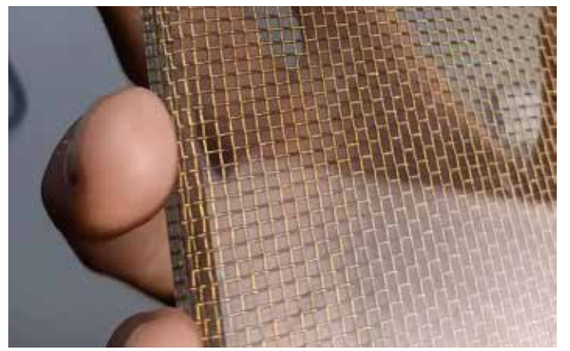
High Strength Safety Performance And Intrusion Resistance After Glass Breakage



Good Edge Stability, Can Be Used With Open Edges

Superior Weather Resistance And Less Prone To Aging

Colorless And Transparent, Not Easily Discolored, Excellent Permeability



Excellent Bonding Performance With Metals

PROCESSING AND FORMING TECHNOLOGY

Processing And Cutting Of SGP Film Before Lamination

- Before laminating SGP film, a stick is used, ionized clean air is blown, and a dust-free cloth is used to wipe the glass original. It is generally not recommended to use a cleaning machine, but if there are too many stains adsorbed on the surface and a cleaning machine must be used, care should be taken not to use cleaning agents, and deionized water with a temperature not exceeding 38 °C can be used. The adhesion between glass cleaned with deionized water and SGP film is higher than that of glass cleaned with tap water.

Lamination

- SGP material must be directly bonded to the tin surface of the glass, i.e. ATTA direction (glass air surface glass tin surface/SGP film/glass tin surface glass air surface). For glass structures that cannot be in contact with the film using tin surface, such as multi-layer laminated glass or non float glass production, it is necessary to use adhesion promoters on the non tin surface. Please consult the after-sales service for the formula and usage method of the bonding accelerator.

Vacuuming

- For SGP films with two or more layers stacked together, laminated glass with multi-layer structure, hot bent or bent steel laminated glass, large area tempered laminated glass, etc., vacuum bag technology should be used. The cold pumping time is generally not less than 7 minutes, and it is best to be above 10 minutes.

Roll-In

- The temperature, roller pressure, and speed selected for the exhaust of SGP laminated glass are basically the same as those of PVB laminated glass. The roller heating temperature is lower and the speed is slower. The mechanical parameter settings can be referred to as follows: preheating of the constant temperature box → surface temperature of the laminated glass is 20 °C -25 °C, humidity is about 25% → first zone constant temperature box is 100 °C -110 °C, the first roller pressure is 0.2Mpa-0.5Mpa, and the roller distance is less than the total thickness of the glass by about 1mm → second zone constant temperature box is 130 °C -140 °C → third zone constant temperature box is 170 °C -180 °C → second roller pressure is 0.3MPa-0.5MPa, and the roller distance is less than the total thickness of the glass by about 2mm.

High Pressure Vessel Process

- The high-temperature and high-pressure treatment of laminated glass in an autoclave is a key process, and controlling the temperature and pressure of the autoclave is an important factor in producing high-quality SGP laminated glass.
  A. The spacing between the laminated glass in the high-pressure reactor and the insertion frame should not be too small, at least about 3cm should be maintained; The local pressure on the glass should be minimized as much as possible. Uneven compression can cause uneven thickness of the SGP film during heating, resulting in optical distortion. The angle of the glass on the bracket should not exceed 10 degrees.
  B. The insulation temperature is controlled between 125 °C -135 °C, and the insulation time of SGP laminated glass is more than 60 minutes. For laminated glass with a thickness exceeding 16mm, the insulation time will be extended. The cooling rate of the high-pressure reactor shall not be less than 3 °C/min, and the pressure shall be controlled between 12Mpa-24Mpa.

COLOR SGP

Our company can produce various color SGP films, including domestic and export color schemes. Includes: porcelain white, milky white, frosted, F-green, ocean blue, brown, gray, blue star gray, European gray, and more.

REGULAR COLORS

Black (opaque to light and shadow)

White(opaque to light and shadow)

Milky white (translucent but opaque)

Whitening (50% translucent shadow)

CUSTOMIZE ANY COLOR

Product Features

The laminated glass made of colored SGP has good transparency, is more beautiful and luxurious, and has texture.

Good weather resistance, able to maintai long-lasting color without fading.

Rich colors can fully showcase design inspiration.

SGP APPLICATION CASE

Hangzhou Airport
Using our company's 1.52mm SGP film

Shanghai Baiyulan Square
Using our company's 0.89mm SGP film

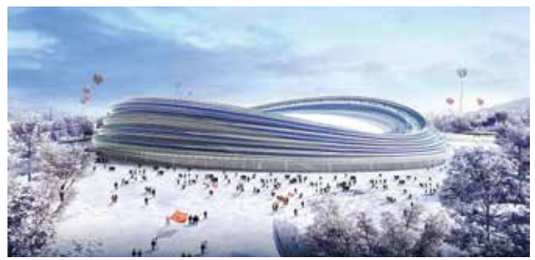
Henglong Square, Kunming
Using our company's 0.89mm SGP film

Sichuan Sanxingdui Museum Project
Using our company's 1.52mm SGP film

Jiangxi Glass Walkway
Using our company's 1.52mm SGP film

Hangzhou Shaw Hospital Project
Using our company's 1.52mm SGP film

Beijing Winter Olympics Speed Skating Hall Project
Using our company's 1.52mm SGP film



Antireflective Glass Of The Mausoleum Of The First Qin Emperor Museum
Using our company's 1.52mm SGP film

05

FUNCTIONAL PVB INTERMEDIATE FILM

- Thermal insulation PVB intermediate film
- Soundproofing PVB intermediate film
- Gradient PVB intermediate film
- Wedge shaped PVB intermediate film
- Color PVB intermediate film

PVB is one of the most cost-effective materials for traditional laminated glass manufacturing. Functional PVB is based on ordinary PVB, achieved by adding various functional media or special processing techniques to achieve certain special effects. PVB insulation has high infrared blocking ability, which can reduce heat conduction and achieve better energy-saving effects. Soundproof PVB has excellent sound damping effect, which attenuates the transmission of sound waves and creates a quieter living environment. The gradient PVB color changes from light to dark, creating a special aesthetic hierarchy and atmosphere. Wedge shaped PVB is an important material for manufacturing automotive head up display glass. Through the principle of refraction of light at different angles, it achieves clearer and more realistic images of the head up display glass, avoiding ghosting. Colorful PVB offers a wide variety of colors to meet more personalized needs.

Maximum Width That Can Be Produced: 3600mm

Product Specifications (coil)

Thickness	Width	Length
0.38mm	500mm-3600mm	400m
0.76mm	500mm-3600mm	200m
1.14mm	500mm-3600mm	150m
1.52mm	500mm-3600mm	100m

Note: Non-standard size can be customized.

Technical Parameters Of PVB Film

Product parameters \ Product Category		0.38mm	0.76mm	1.52mm
length tolerance		+(0-5)	+(0-2)	+(0-1)
Width tolerance		+(0-15)	+(0-15)	+(0-15)
Tolerance		±0.02	±0.03	±0.05
Moisture content		≤0.5%	≤0.5%	≤0.5%
Tensile strength		≥20	≥20	≥20
Haze	Architectural grade	<0.4	<1.5	<2.0
	Automotive grade	<0.6	<0.8	—
Shrinkage rate (60°C/15min)		<10	<10	<10
Transmittance		≥88	≥85	≥85
Elongation at break		≥200	≥200	≥200
Bonding strength		≥7	≥7	≥7
Yellowing index		≥1.5	≥1.5	≥1.5

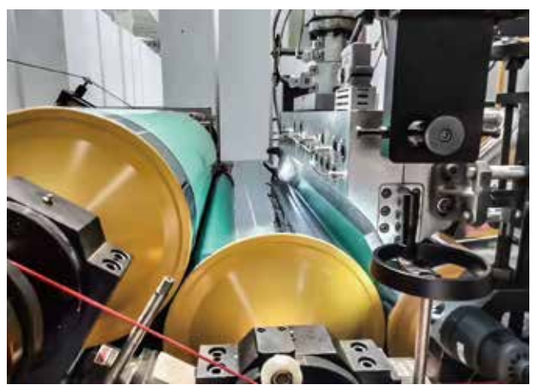
06

OUR ADVANTAGES

- 01/ One of the earliest domestic enterprises to invest in research and development and production of SGP film, with mature technology;
- 02/ Short delivery cycle, timely after-sales service, and can provide customers with professional production site process technology guidance;
- 03/ We can customize production according to customer requirements and produce ultra wide SGP film with a maximum width of 4300mm;
- 04/ The product quality is stable and has passed ISO9001 quality system certification, China National Building Materials Inspection and Certification, GJB9001C: 2017 National Army certification, SGS certification, American ANSI certification, American SGCC certification, and EU CE certification.

QUALITY CONTROL SYSTEM

The enterprise strictly implements quality control in accordance with the national military standard GJB9001C: 2017 and ISO9001 quality management procedures, implements a high standard comprehensive quality tracking management system, and inspects the entire product process in accordance with a four level quality control system:Raw material incoming inspection →pre production inspection preparation→processing quality inspection→finished product quality inspection. By inspecting the quality of products during production and processing, timely discovering and correcting non-conforming products during the processing, and preventing non-conforming products from flowing into the next process or customers.



Our Partners

中国兵器工业集团有限公司
CHINA NORTH INDUSTRIES GROUP CORPORATION LIMITED

中国兵器装备集团

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AECC

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ANGLE-TECH

Professional TPU SGP Intermediate Film Manufacturer