CYTEC

UVEKOL®

Glass Laminating System

CYTEC

About Us

Total Solutions Provider

Cytec Industries is one of the world's leading specialty chemicals and materials technology companies. Our focus is on creating advanced technological solutions in global markets, including aerospace, coatings, mining, plastics.

We are a total solutions provider with a broad range of products, including eco-friendly technologies. We support our customers worldwide with excellent technical service and applications research.

Innovative Technology

Cytec's products are innovative and diverse, and can help manufacturers realize the competitive advantages of environmental compliance, while also meeting their needs for:

- Improved performance (scratch/stain/corrosion resistance, and adhesion)
- Greater ease of application (required cure response)
- Better finishes (gloss/matte, texture, and specialty)

Broad Product Portfolio

We offer an extensive selection of performance-driven products, including low volatile organic compounds (VOC) and hazardous air pollutant substance-free (HAPS) technologies, for existing and emerging markets:

- Industrial
- Architectural/Construction
- Automotive/Transportation
- Wood/Paper
- Plastic
- Opto-electronics
- Graphic Arts
- Packaging/Adhesives

Our product portfolio is inclusive:

- UV/EB energy curable resins
- Liquid coating resins
  - *Waterborne*
  - *High solids*
  - *Solventborne*
- Amino crosslinkers
- Powder coating resins
- Coating additives

Global Technical Support

Through our manufacturing facilities, technology and distribution centers, we are able to provide responsive service on a consistent global basis, and to help our customers identify and profit from emerging opportunities.

Safety 2

Security 3

Sound 4

UVEKOL®

About UVEKOL

Your partner in glass lamination

UVEKOL technology has given glassmakers, architects and designers unprecedented creative freedom to meet the ever-changing needs of their clients. UVEKOL interlayers have been used for nearly 25 years to create laminated glass providing superior safety, security, acoustical and design benefits. UVEKOL glass laminates are strong enough to consistently deliver the strength and durability needed to meet the world's most stringent engineering standards.

UVEKOL is one of the most advanced glass laminating products on the market today, offering glassmakers and their customers flexibility and high performance at a relatively low investment.

Applications

UVEKOL's strength and durability make it ideal for a variety of applications. Some of the most common include:

Safety

UVEKOL helps prevent glass shards from spreading upon impact.

Security

UVEKOL is qualified for a wide range of security applications.

Sound

UVEKOL has superior sound deadening properties.

Design

UVEKOL allows flexibility in shapes and forms.

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Safety

Protecting People

Glass laminated with a UVEKOL interlayer at the appropriate thickness will result in safety glass. On impact, the glass fragments adhere to the interlayer, significantly reducing the risk of serious injury.

These UVEKOL laminates meet the highest level of performance in all relevant European and national norms, as well as US norms for safety glazing. UVEKOL laminates are widely used in architectural and speciality applications. Typical applications include storefronts, elevator shafts, staircases, glass doors, interior glazing and balconies.

Safety Performance

TEST	NORM	COUNTRY	PERFORMANCE	EXAMPLE COMPOSITION*	UVEKOL GRADE
PENDULUM TEST - TYRES	EN12600	Europe	1B	4 / 1 / 4	UVEKOL A
	EN12600		1B	4 / 1 / 4	UVEKOL S
PENDULUM TEST - SHOT BAG	DIN52337	Germany	PW-1200	4 / 1 / 4	UVEKOL A
			PW-1200	4 / 1 / 4	UVEKOL S 20
OVERHEAD GLAZING	DIB OHG	Germany	Passes	4 / 2 / 4	UVEKOL S/OHG
PENDULUM TEST - SHOT BAG	BS 6206	U.K.	CLASS A	3 / 0.8 / 3	UVEKOL S15
PENDULUM TEST - SHOT BAG	NF P 08-301	France	M50 – 900 J = 1350 mm	4 / 1 / 4	UVEKOL A
	NF P 08-302		M50 – 900 J = 1350 mm	4 / 1 / 4	UVEKOL S
HARD IMPACTER	NF P 08-301	France	D1 – 10 J	4 / 1 / 4	UVEKOL S
	NF P 08-302				
GUARD-RAIL SAFETY	NF P 01-013	France	3.75 J – D 0.5	4 / 1 / 4	UVEKOL A
	Avis Technique		certification in progress	4 / 1 / 4	UVEKOL S15
GUARD-RAIL SAFETY	STS 54	Belgium	passes	8 / 2 / 8	UVEKOL S
PENDULUM TEST - SHOT BAG	ANSI Z97.1.1984	U.S.A.	48"+1219 mm	4 / 1 / 4	UVEKOL A
			48"=1219 mm	4 / 0.8 / 4	UVEKOL S15
HURRICANE	Florida Building Code and others	U.S.A.	passes	4 / 2.5 / 4	UVEKOL S

* Example laminate composition, eg 4/1/4 means 4 mm float glass, 1mm Uvekol interlayer, 4mm float glass. Increasing the thickness of the interlayer and the total laminate improves its safety and security performance. These compositions are examples of typical laminate compositions and their performance, yet higher levels can be achieved.

UVEKOL®

Security
Protecting People and Property

Typical applications
- anti-burglary glazing
- store fronts
- anti-vandalism windows
- automotive glazing

Security

UVEKOL's formidable strength greatly reduces the threat of forced entry in commercial and residential properties, while multi-layer systems can resist bullet penetration from medium to high-powered arms.

UVEKOL laminates have been tested in various set-ups for their security performance, meeting many national and international standards.

SECURITY PERFORMANCE

Impact test

TEST	NORM	COUNTRY	PERFORMANCE	EXAMPLE COMPOSITION*	UVEKOL GRADE
IMPACT FALLING BALL	EN356	Europe	min. P1A	3 / 0.8 / 3	UVEKOL S
				3 / 1 / 3	UVEKOL A
			max. P5A	3 / 2.7 / 3	UVEKOL S
IMPACT FALLING BALL	DIN52290/4	Germany	min. A1 – 3.5 m	4 / 1.2 / 4	UVEKOL S20
			max. A3 – 9.5 m	3 / 1 / 4 / 1 / 3	UVEKOL S20

Forced Entry

TEST	NORM	COUNTRY	PERFORMANCE	EXAMPLE COMPOSITION*	UVEKOL GRADE
AXE	EN356	Europe	min. P6B	4 / 2 / 4 / 2 / 4	UVEKOL S
			max. P8B	5 / 2 / 10 / 2 / 5	UVEKOL S20
AXE	DIN52290/3	Germany	min. B1 / (P6)	4 / 2 / 4 / 2 / 4	UVEKOL S20
			max. B3 / (P8)	5 / 3 / 4 / 2 / 5	UVEKOL S
BALL PEEN	ASTM A233	U.S.	SEQUENCE 1 BODY ENTRY : PASS	6 / 3 / 6	UVEKOL S

Anti Bullet

TEST	NORM	COUNTRY	PERFORMANCE	THICKNESS (mm)	UVEKOL GRADE
BULLET	DIN52290/2	Germany	min. C1-SA	24	UVEKOL S20
			max. C4-SA	52	UVEKOL S20
BULLET	BS5051/1	U.K.	min. G0	27	UVEKOL S20
			max. G3	52	UVEKOL S20
BULLET	CEBTP E05/201	France	min. 1	24	UVEKOL S20
			max. 4/5	51	UVEKOL S20
BULLET	STS38	Belgium	min. 1 / T8	24	UVEKOL S20
			max. 5A / T8	52	UVEKOL S20
BULLET	HPW-TP-0500.03	U.S.A.	min. level A	32	UVEKOL S
			max. level B	32	UVEKOL S
BULLET	HPW-TP-0500.03	U.S.A.	level IIIA	39	UVEKOL S

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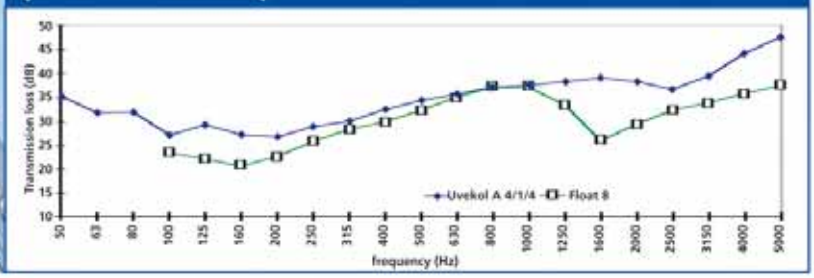
Sound

Acoustic Control

UVEKOL laminated glass is used widely in hotels, public buildings and homes to create a safe and quiet environment. UVEKOL laminates are amongst the best performing products for sound reduction.

Elasticity of the UVEKOL interlayer provides excellent sound-deadening properties for UVEKOL laminates. As an effective noise barrier, UVEKOL contributes greatly to the quality of life as living and workspaces become more and more congested.

ACOUSTIC PROPERTIES OF UVEKOL LAMINATES (SAFETY THICKNESS)



A typical UVEKOL A laminate (4/1/4) gives a sound reduction (Rw) of 37 dB. While UVEKOL A was designed for acoustic control, UVEKOL S types also provide exceptional sound reduction.

Quiet Nights

The three-layered insulated windows of Nuremberg's Pyramide Hotel offer guests a quiet night's sleep - even though the hotel is located next to one of the busiest highways in Germany.

Keeping noise below a 40-db level was just one of many challenges faced by Karl-Heinz Lagaly, the Managing Director leading the Pyramid Hotel project. German construction codes specify P3 security and a k-value of 1.1 and architects are personally held responsible for the safety of the structures they build. It is not hard to imagine that Lagaly had more than one restless night. Since UVEKOL was used to bond the glass, the architect sleeps quietly too.

ACOUSTIC PERFORMANCE
UVEKOL A - designed for Acoustic control

COMPOSITION	THICKNESS	ACOUSTIC PERFORMANCE					
	mm	Rw	RA rail	RA plane	RA rose	RA route	RA music
		dB	dBA	dBA	dBA	dBA	dBA
4 / 1 / 4	9	37	17	35	36	33	33
6 / 1 / 6	13	38	–	–	–	–	–
8 / 1 / 4 / 2 / 4	19	41	–	–	–	–	–
10 / 11.5 AS / 4 / 1.2 / 6	32.7	43	–	–	43	39	–
4 / 1 / 5 / 20 AS / 4 / 2 / 5	41	48	–	–	–	–	–
4 / 1 / 5 / 20 GAS / 4 / 2 / 5	41	52	–	–	–	–	-

AS:Air space GAS: Gas filled space

ACOUSTIC PERFORMANCE
UVEKOL S Types - designed for Safety and Security

GRADE	COMPOSITION	THICKNESS	ACOUSTIC PERFORMANCE					
		mm	Rw	RA rail	RA plane	RA rose	RA route	RA music
			dB	dBA	dBA	dBA	dBA	dBA
S	4 / 1 / 4	9	35	34	33	34	32	31
S	4 / 1.5 / 4	9.5	35	34	33	35	32	32
S15	4 / 1.5 / 4	9.5	35	34	33	34	32	32
S20	4 / 1.5 / 4	9.5	35	34	33	34	31	31
S20	4 / 2 / 5 / 2 / 4	17	36	–	–	–	–	–
S	6 / 2 / 6 / 2 / 6	22	40	39	38	40	37	37

UVEKOL®

Design

Flexible in Design

Curved glass, coloured glazing, irregular shapes and surfaces are all possible with UVEKOL. And because of its strength it can be used for a variety of demanding architectural and structural applications.

UVEKOL S Laminates Sound Deadening Performances

While UVEKOL S has been specifically designed for safety and security purposes, it also provides exceptional acoustical properties. As shown in the charts left, a single layer UVEKOL S laminate will already result in a Rw of 35, while its use in IG units has shown to increase this value to 44.

Crystal Clear

The clear, majestic curved corners of England's Jubilee Building were a challenge to create, to say the least. "There is inevitably a slight loss of optical quality when bending glass," says Ken Woodcock, Managing Director at Novaglaze. "But UVEKOL minimises the distortions and corrects slight imperfections that result from the bending process."

Even more impressive is UVEKOL's durability, delivering impact resistance on uneven surfaces. "UVEKOL has intrinsic strength," says Woodcock. "Even if the glass is struck with enough force to shatter it, UVEKOL's strength can allow it to hold its shape."

"UVEKOL's smooth flowing character was vital in this process. Without it, the project would have been virtually impossible."

- Ken Woodcock,
Managing Director - Novaglaze

Each corner window of the Jubilee Building is made of two layers of laminated glass. The outer layer consists of two sheets of 4mm green glass laminated together, while the inside layer features two pieces of 4mm laminated low E glass. These 1 metre x 2.5 metre sheets were all laminated with 1.5mm of UVEKOL.

Harmony

The picturesque Albis Church, located in the Swiss Alps, was recently renovated. The church was in urgent need of better insulation against icy winter temperatures, but everyone concerned was anxious to retain the serene effect created by the church's antique stained glass.

Combining modern technology and ancient artwork in a single glazing system of this complexity had never been accomplished before. Urs Reinhard of Glas Reinhard in Lucerne immediately recognised that UVEKOL offered the perfect solution.

"The rough texture and uneven surfaces of handmade glass does not readily permit any other attaching mechanism," says Reinhard. "the only products that allow you to do this are UVEKOL and silicone. The biggest advantages of going with UVEKOL were cost and easy manipulation. Since it is a liquid, UVEKOL flows automatically into every cavity and ensures that both the panel and the strip are uniformly attached."

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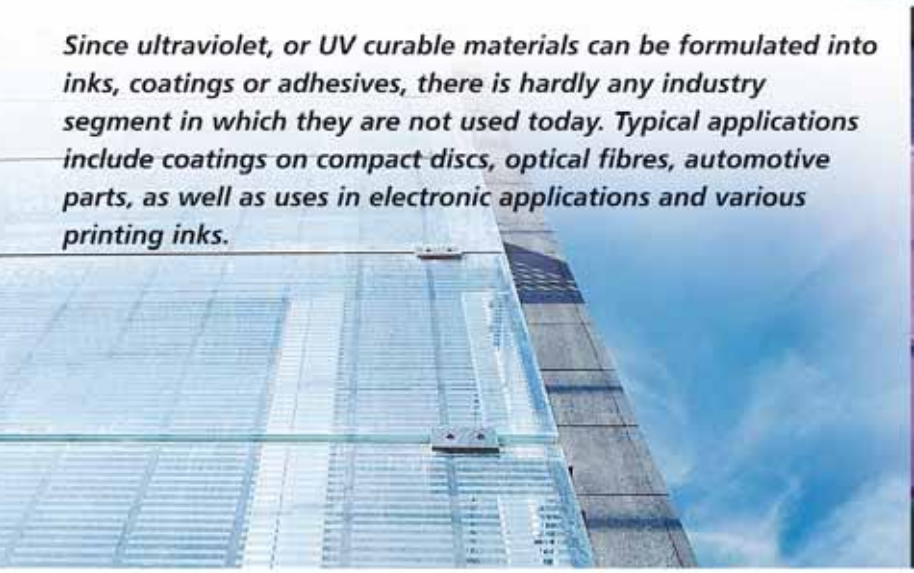
Technology

UV Curing Technology *Easy Process, Powerful Results*

Since ultraviolet, or UV curable materials can be formulated into inks, coatings or adhesives, there is hardly any industry segment in which they are not used today. Typical applications include coatings on compact discs, optical fibres, automotive parts, as well as uses in electronic applications and various printing inks.



UV curable products do not dry through evaporation of solvents, but are converted to a solid state through a chemical process called polymerisation - which only takes place when the products are exposed to ultraviolet light, giving greater control over cure times, quality and consistency.

Laminated glass curing with ultraviolet light can take as little as twenty minutes, leaving glass stronger, and with powerful new physical properties.

Cytec is the world leader in UV curing technology.

Technology Process UV Glass Lamination

The UVEKOL glass lamination process is based entirely on solvent-free, low pressure/low energy UV curing technology, which allows for substantial reductions in both investment and energy costs when compared to traditional glass lamination.

In UV glass lamination, the interlayer is a plastic polymer delivered in a liquid form. The UVEKOL interlayer is not pre-formed and sold as sheets, but is instead created through polymerisation at the time of lamination in made-to-size pieces. As a result, laminated glass-cutting waste is eliminated and even small runs become easy and cost-effective.

Since UVEKOL will only solidify when exposed to ultraviolet light, it is supplied as a ready-to-use, one component system. This ensures more control and consistent results because the product is not affected by mixing parameters or ambient temperature during the curing process.

UVEKOL®

Technology

UVEKOL's Four-Step Process

UVEKOL products are solvent-free systems, delivered as a ready-to-use liquid. The laminating process consists of four simple steps: cleaning, taping, filling and curing.

Cleaning
Wash and dry the panes of glass.

Taping
Apply double-sided adhesive tape to the perimeter of one glass pane and assemble the two panes. The tape retains the liquid and determines the thickness of the UVEKOL interlayer.

Filling
Fill the space between the two panes of glass with UVEKOL. Since it is pumped in liquid form, UVEKOL spreads evenly - even between irregular surfaces.

Curing
Curing begins only when you place the glass under UV lamps, giving you greater control over the process. The cure time is typically 20 minutes.

UVEKOL Technology is:

Easy to use
There is no mixing involved. Dosing quantities and curing times are well defined and not influenced by changing temperatures. The lamination is done at ambient temperature and pressure.

Fast and flexible
The use of UV technology allows for fast and efficient custom laminating.

Consistent
There is no variation in quality from batch to batch, and since curing happens only under UV light, you gain complete control of the curing process.

Simple
Any glass worker can quickly learn UVEKOL's simple four-step process.

For more information on required equipment and suppliers, please contact us directly.

Partners in excellence

Cytec has partnerships with recommended glass fabricators world-wide, which you can find on **www.uvekol.com**. If you are considering starting your own laminated glass production, please contact us.

Cytec offers a real partnership to glass fabricators and window and door makers.
This extends from evaluation and application development to performance testing, to laminates assistance in line set-up and start-up.

Our experts are a reliable asset to help you as you innovate your glass production business. Feel free to contact us any time at the address on the back cover.

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Products

Product Range

The UVEKOL product range includes S-types (S, S15, S20) which are particularly known for their exceptional performance in safety and security. UVEKOL A was designed for sound control and provides the highest level of acoustic damping. The portfolio also includes pigments and tapes used for the manufacture of UVEKOL laminates.

UVEKOL Grades and Characteristics

	UVEKOL A	UVEKOL S	UVEKOL S15	UVEKOL S20	UVEKOL S/OHG
Application					
ACOUSTIC GLAZING	••••	••	••	••	••
SAFETY GLAZING	•••	••••	••••	••••	••••
SECURITY GLAZING	••	••••	•••	••••	••••
BULLET-RESISTANT GLAZING		••	••	••••	••
STRUCTURE ELEMENTS			••••		
Type of glass					
NORMAL FLOAT	••••	••••	••••	••••	••••
TEMPERED	•••	••••	••••	••••	••••
BENT	•	•••	••••	•••	•••
COLOURED FLOAT	••••	••••	••••	••••	••••
COATED *	•••	•••	•••	•••	•••
Product processing					
SPEED OF FILLING	••••	••	•••	••	••

** all grades can be used with most coated glasses but please contact SURFACE SPECIALTIES Technical Service - UVEKOL Department for specific cases.*

- • *Poor*
- •• *Moderate*
- ••• *Good*
- •••• *Very good*

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