

# UVEKOL®

Glass Laminating System



# About allnex



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# Facts & Figures

- Global company with €2.2 bn in sales
- Broad Technology portfolio: liquid coating resins, energy curable resins, powder coating resins, crosslinkers and additives, composites and construction materials
- Approximately 4000 employees
- Customers in more than 100 countries
- 33 manufacturing facilities
- 23 research and technology centers
- 5 joint ventures
- Extensive range of solutions for key coating segments: automotive, industrial, packaging coating and inks, protective, industrial plastics and specialty architectural

With manufacturing, R&D and technical facilities located throughout Europe, North America, Asia Pacific and Latin America, allnex offers global and reliable supply of resins and additives combined with local, responsive customer support.

## About us

### **An Expansive Portfolio**

allnex is a complete solution provider for customers requiring high-value surface technologies in market segments that include industrial coatings, automotive, architectural and protective, consumer electronics and industrial plastics, and packaging coatings and inks.

We offer our customers advanced and diverse products and technologies for surfaces such as UV/EB curable resins and additives, powder coating resins and additives, liquid resins and additives, as well as crosslinkers.

We are committed to working with our customers to develop advanced solutions, and we are dedicated to open communications on the safe handling, distribution, use and disposal of the products we make.

### **A Focus on Customer Satisfaction**

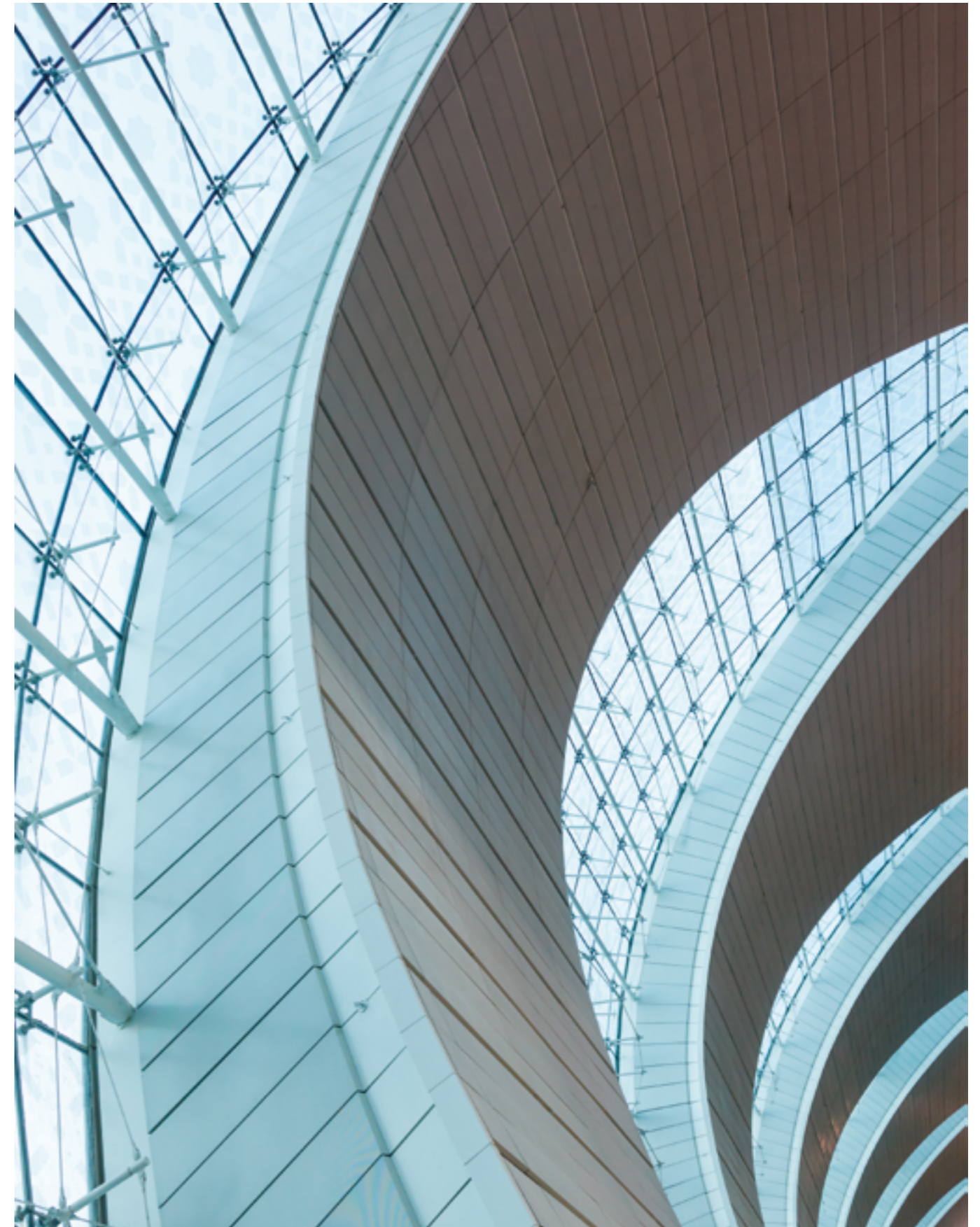
allnex operates a globally integrated set of order fulfillment IT systems and processes. All allnex personnel in the order fulfillment processes are dedicated to delivering customer satisfaction through reliable and cost-effective supply of product to our customers. allnex has specialized personnel in Customer Service, Procurement, Manufacturing, Planning and Logistics to achieve this goal. In addition to timely and accurate order fulfillment, there is an equally important focus on maintaining safety and protecting the environment at all steps in the process, from the procurement of raw materials to the delivery of finished goods to the customer's door.

### **Dedication to Operational Excellence**

The Manufacturing Organization of allnex operates globally to provide superior service to our customers in all regions. Our vision of operational excellence brings value to our customers through ongoing, continuous improvement initiatives, including Lean Manufacturing, Six Sigma Principles, and Best Practice Engineering. Our value proposition is driven by excellence in our Safety, Environmental, Quality Systems and Employee Development Programs. We are structured by business technology, which enables our sites to work transparently with R&D, Customer Service and the Businesses, to share best practices across common processes. We are also able to gain leverage from overall global manufacturing synergies to efficiently meet customer needs.

### **Key Product Lines**

- UV/EB Curable Resins and Additives
- Liquid Resins and Additives
- Powder Coating Resins and Additives
- Crosslinkers



## 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 more than 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 technology is

- **Low Capital Investment**  
UVEKOL requires low Capital Investment, can be processed under any climatic conditions, allows easy resin residual removal and requires extremely low electricity consumption.
- **Easy to Use**  
Dosing quantities and curing times are well defined and not influenced by changing temperatures. The lamination is done at ambient temperature and pressure. Any glass worker can quickly learn UVEKOL's simple four-step process.
- **Fast**  
The use of UV technology allows for fast and efficient custom laminating. It allows just-in-time manufacturing. Lamination is done in 20 minutes.
- **High Quality and Flexibility**  
UVEKOL offers excellent quality lamination. It allows custom shapes and sizes lamination as well as the use of a wide variety of glass types.
- **Consistent**  
UVEKOL is a one component system which does not require mixing. 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.



## Safety

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 specialty applications.

Typical applications include storefronts, elevator shafts, staircases, glass doors, interior glazing and balconies.

### Safety Performance

Test	Norm	Country	Performance	Example Composition*		UVEKOL Grade			
				mm	inches				
Pendulum Test	EN12600	Europe	1B	4 / 1 / 4	5/32 / 0.040 / 5/32	UVEKOL A			
	EN12600		1B	4 / 1 / 4	5/32 / 0.040 / 5/32	UVEKOL S			
Pendulum Test - Shot Bag	ANSI Z97.1 CPSC 16CFR 1201	USA	Passes Cat II	4 / 1 / 4	5/32 / 0.040 / 5/32	UVEKOL A			
				3 / 0.8 / 3	1/8 / 0.030 / 1/8	UVEKOL S			
Hurricane	International Building Code Section 1609.1.4	USA	Passes	3 / 2.5 / 3**	1/8 / 0.100 / 1/8	UVEKOL S			
				ASTM E 1886 ASTM E 1996	USA	Passes	3 / 2.5 / 3**	1/8 / 0.100 / 1/8	UVEKOL S
				Miami-Dade TAS 201, 202, 203	USA	Passes	3 / 2.5 / 3**	1/8 / 0.100 / 1/8	UVEKOL S

\* Example laminate composition, e.g. 4/1/4 means 4 mm float glass, 1 mm UVEKOL interlayer, 4 mm 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.

\*\* This is a minimum. The thickness of glass and the interlayer depends on expected wind load and performance of the window.



"Aldora Glass and Aluminium provides hurricane resistant glass to our customer base located throughout the high velocity hurricane zones of Florida and the Caribbean. We have found the product easy to produce with few variables, thus few opportunities for mistakes at the manufacturing level. The reliability at the production level creates fewer failures in the field. Our calls for product issues are minimal which gives us great peace of mind.

We test our aluminum door and frame products with both PVB and UVEKOL S in the lab. UVEKOL S outperforms PVB in both impact and cycling tests and helps us achieve higher design pressures with our products.

allnex has been great to work with. Their regular audits assure our customers that we are conforming with the manufacturing requirements of the product and assists us in meeting Miami- Dade Quality Assurance protocol.

UVEKOL S has been a great product for Aldora for the past 10 years and we look forward to the next 10!"

**Jim Pande**  
Aldora Glass and Aluminium

# Security

## Protecting People and Property

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.

## Typical applications:

- Anti-burglary glazing
- Store fronts
- Anti-vandalism windows
- Automotive glazing

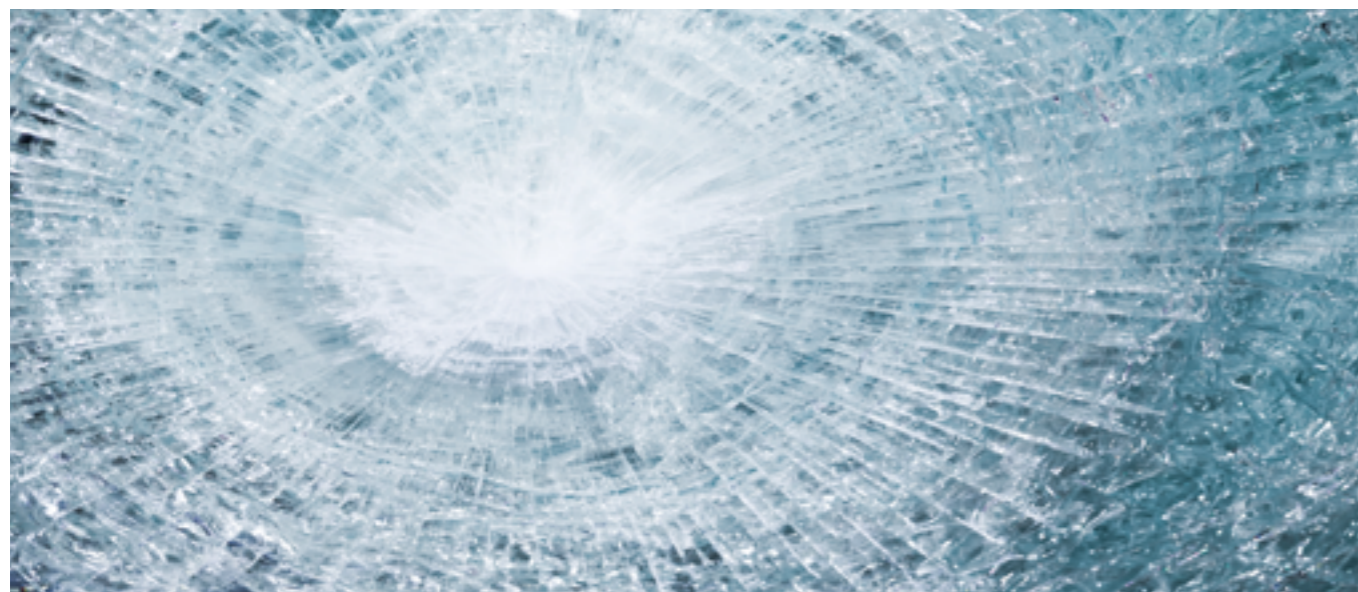
## Impact Test

Test	Norm	Country	Performance	Example Composition*		UVEKOL Grade
				mm	inches	
Impact Falling Ball	EN356	Europe	min. P1A max. P5A	3 / 1 / 3	1/8 / 0.040 / 1/8	UVEKOL A
				3 / 1 / 3	1/8 / 0.040 / 1/8	UVEKOL A, S and S15
				3 / 2.7 / 3	1/8 / 0.105 / 1/8	UVEKOL S

## Forces Entry

Test	Norm	Country	Performance	Example Composition*		UVEKOL Grade
				mm	inches	
Axe	EN356	Europe	min. P6B	4 / 2 / 4 / 2 / 4 5 / 2 / 10 / 2 / 5	5/32 / 0.080 / 5/32 / 0.080 / 5/32 3/16 / 0.080 / 3/8 / 0.080 / 3/16	UVEKOL S UVEKOL S20
Ball Peen	ASTM E 1233	USA	Level 1 Body Entry : Pass	6 / 3 / 6	1/4 / 0.120 / 1/4	UVEKOL S

\* Example laminate composition, e.g. 4/1/4 means 4 mm float glass, 1 mm UVEKOL interlayer, 4 mm 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.



# Fire resistance

## Heat / Fire resistance and Impact Resistance

Fire-Rated glass ceramic laminates based on UVEKOL®FR-C and Fire-Rated borosilicate glass laminates based on UVEKOL FR meet the highest safety glazing standards and pass successfully fire tests without ignition of the interlayer.

## Physical Properties UVEKOL FR-C and UVEKOL FR

Property	Unit	Value UVEKOL FR-C	Value UVEKOL FR
Refractive index -25°C	-	1.4818	1.4597
Color (Lovibond)	Alpha	<100	<50
Dynamic viscosity, cone & plate -25°C	mPa.s	140	30
Density -23°C	g/cm3	1.38	1.06
Shore A hardness after cure 21°C	-	35	30
Shrinkage during polymerization	%	10	10

## Ageing of UVEKOL FR-C based glass laminates

Resistance	Test	Standard	Performance
Heat	Resistance to temperature changes – Klima test cycles between -35°C and +80°C	DIN 52344	100 cycles No defects/no delamination
Heat + Moisture	Durability test = high temperature test (hot boiling test)	EN 12543-4	No defects
UV	Q-panel ageing – 351 nm continuous UV irradiation	ASTM G53	4 / 1 / 4 glass ceramic laminate 960 h ΔE* = 1.3 1,500 h ΔE = 1.6 2,100 h ΔE = 1.7
	Florida natural ageing Sun-Tropical Testing Service orientation 5° south	ASTM G7 (ANSI Z97.1)	4 / 1.5 / 4 glass ceramic laminate after 15 months: ΔE = 1.4 No defects

## Ageing of UVEKOL FR based glass laminates

Resistance	Test	Standard	Performance
Heat	Temperature stability test avon ageing -60°C	-	5 / 1 / 4 laminate After 1100 hours ΔE* = 0.5 No defects (delaminations, others)
	Resistance to temperature changes – Klima test cycles between -30°C and +80°C	DIN 52344	100 cycles No defects (delaminations, others)
Heat + Moisture	Durability test – high temperature test (hot boiling test)	EN 12543-4	4 / 1 / 4 laminate 2 mm white border No defects
	Q – Panel ageing – 351 nm continuous UV irradiation	ASTM G53	4 / 1 / 4 laminate, oat with ceramic After 1080 hours : ΔE = 0.7 After 2350 hours : ΔE = 1.5 No defects

\* ΔE is a measure for a difference in color = color after ageing minus color before ageing (in L\*, a\*, b\*)

# Sound

## Acoustic Control

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 damping or sound deadening is usually

expressed in a single value rating, Rw (valid for EU), STC or OITC (valid for US). The tables ow reflect acoustical performance for a given composition.

UVEKOL S has been specially designed for safety and security it also provides exceptional acoustical properties.

The use in IG units is further increasing this value.

Rw = STC	OITC	Overall Thickness	Inboard Lite		Test Number
			mm	inches	
36	27	6 mm	3 / 0.8 UVEKOL A / 3	1/8 / 0.030 UVEKOL A / 1/8	65766.01D
34	27	6 mm	3 / UVEKOL S / 3	1/8 / UVEKOL S / 1/8	65766.01D

Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.  
Standard Test Method: ASTM E 90-04

Testing conducted at ATI (Architectural Testing Inc.)

Rw = STC	OITC	Overall Thickness	Outboard Lite		Spacer	Air Space Gas	Test Number	
			mm	inches				
40	31	25 mm	6 mm	12.5 mm AL	3 / 1 UVEKOL A / 4	1/8 / 0.040 UVEKOL A / 5/32	Air	TL08-108

Testing conducted at WEAL (Western Electro-Acoustic Laboratory)

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.



# Sound and design

## Acoustic Performance - UVEKOL® A - Designed for Acoustic control

Composition	Thickness	Acoustic Performance					
		Rw (dB)	RA rail (dBA)	RA plane (dBA)	RA Rose (dBA)	RA Route (dBA)	RA music (dBA)
4 / 1 / 4	9 mm	37	17	35	36	33	33
6 / 1 / 6	13 mm	38	-	-	-	-	-
8 / 1 / 4 / 2 / 4	19 mm	41	-	-	-	-	-
10 / 11.5 AS / 4 / 1.2 / 6	32,7 mm	43	-	-	43	39	-
4 / 1 / 5 / 20 AS / 4 / 2 / 5	41 mm	48	-	-	-	-	-
4 / 1 / 5 / 20 GAS / 4 / 2 / 5	41 mm	52	-	-	-	-	-

AS = Dry Air ; GAS = SF<sub>6</sub>

## Acoustic Performance - UVEKOL S - Designed for Safety and Security

Grade	Composition	Thickness	Acoustic Performance					
			Rw (dB)	RA rail (dBA)	RA plane (dBA)	RA Rose (dBA)	RA Route (dBA)	RA music (dBA)
S	4 / 1 / 4	9 mm	35	34	33	35	32	31
S	4 / 1.5 / 4	9,5 mm	35	34	33	35	32	32
S15*	4 / 1.5 / 4	9,5 mm	35	34	33	34	32	32
S20*	5 / 1.5 / 5	9,5 mm	35	34	33	34	31	31
S20*	5 / 1.5 / 5	17 mm	36	-	-	-	-	-
S	6 / 2 / 6 / 2 / 6	22 mm	40	39	38	40	37	37

\* Only available in Europe



## Flexible in Design

Curved glass, colored 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.

"We have successfully used UVEKOL for more than a decade to produce our high-quality specialty glasses. The superior product quality and outstanding optical properties are a perfect fit for our needs. The ability to produce individual pieces as well as large quantities in a feasible manner are equally important to us and were a key factor to choose UVEKOL over other methods of lamination."

**Peter Platz**  
Director, Peter Platz Spezialglas GmbH

Courtesy of: Carsten Platz, Peter Platz Spezialglas GmbH  
Photo taken by Ivane Goliadze

# 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 optical fibers, 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 polymerization 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. allnex is the world leader in UV curing technology.

## Technology Process. UV Glass Lamination

The UVEKOL® glass laminating 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 polymerization 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'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.

## Partners in excellence

allnex has partnerships with glass fabricators worldwide. If you are considering starting your own laminated glass production, please contact us. allnex 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 addresses on the back cover.

# Products

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

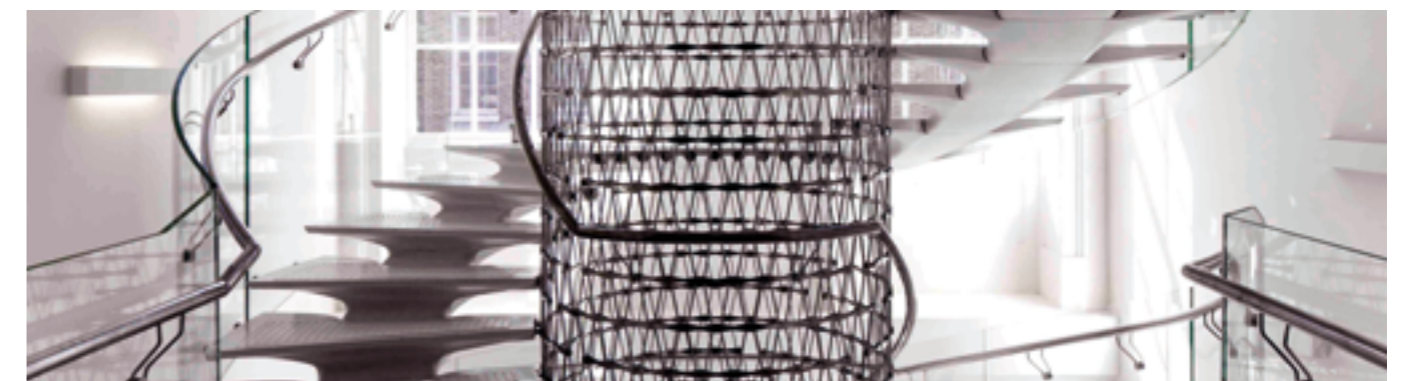
Application	UVEKOL A	UVEKOL S	UVEKOL S15*	UVEKOL S20*
Acoustic Glazing	●●●●	●●	●●	●●
Safety Glazing	●●●	●●●●	●●●●	●●●●
Security Glazing	●	●●●●	●●●	●●●●
Bullet-Resistant Glazing		●●●	●●	●●●●
Structure Elements			●●●●	

Type of Glass	UVEKOL A	UVEKOL S	UVEKOL S15*	UVEKOL S20*
Normal Float	●●●●	●●●●	●●●●	●●●●
Tempered	●●●	●●●●	●●●●	●●●●
Bent	●	●●●	●●●●	●●●●
Coloured Float	●●●●	●●●●	●●●●	●●●●
Coated (to be tested)	●●●●	●●	●●●	●●●

Product Processing	UVEKOL A	UVEKOL S	UVEKOL S15*	UVEKOL S20*
Speed of Filling	●●●●●	●●●	●●●●	●●
Viscosity cps		120/130	75	200

● Poor  
●● Moderate  
●●● Good  
●●●● Very good  
●●●●● Excellent

\* Only available in Europe

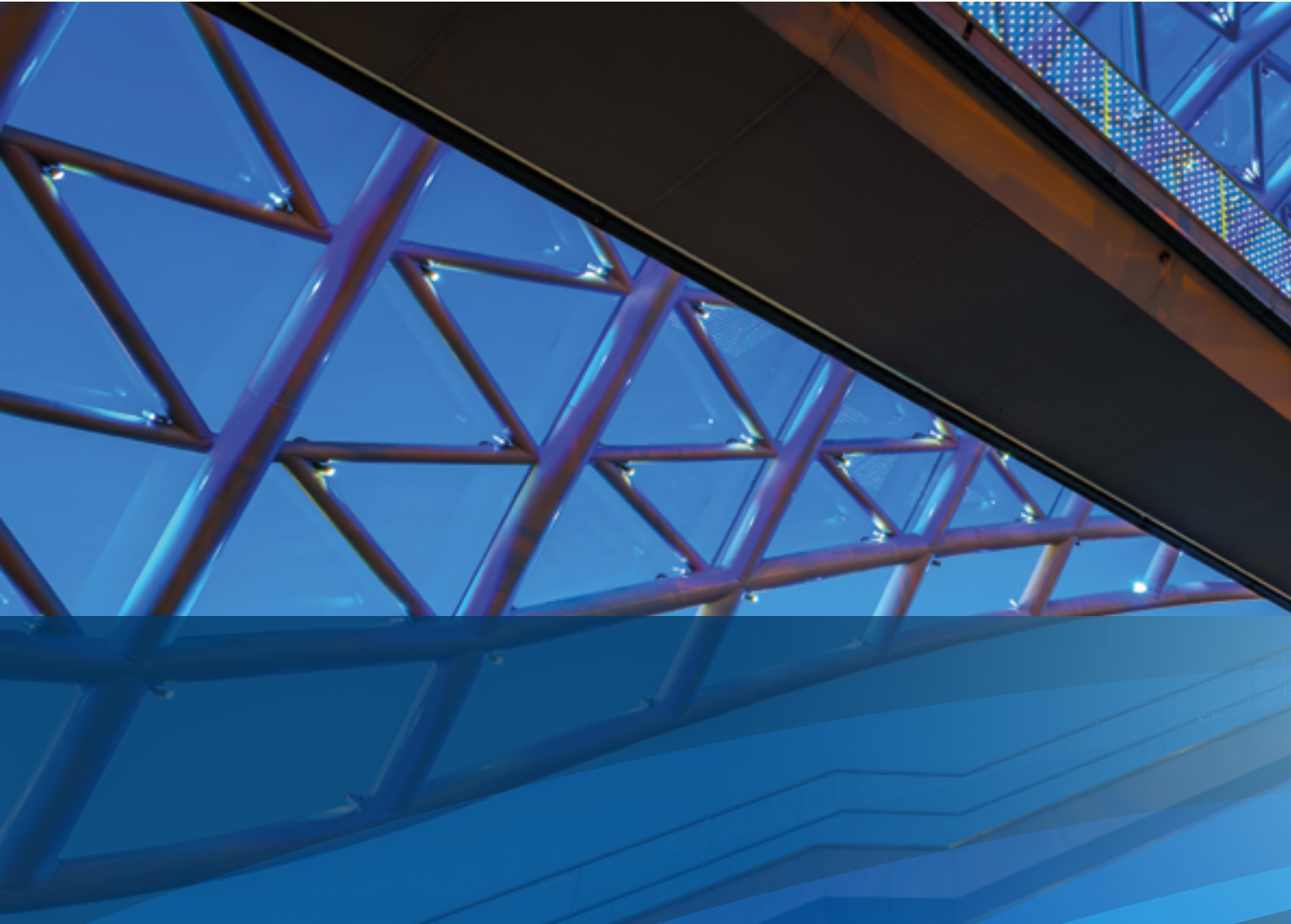


Somerset House is a new kind of arts center in the heart of London. Chosen for both its outstanding glass clarity and safety capabilities, UVEKOL was used on the glass panels of the spiral staircase, a project which earned Somerset House an award.

Courtesy of: Andrew Taylor, Director, Specialist Glass Products Ltd.







### **Corporate Center**

Frankfurt  
The Squaire  
Am Flughafen  
D 60549 Frankfurt am Main  
Germany

The operating allnex group is legally owned by Allnex Holdings S.à r.l., a company based in Luxembourg, which also provides long term strategic decisions relating to its investment in allnex.

**[www.allnex.com](http://www.allnex.com)**

