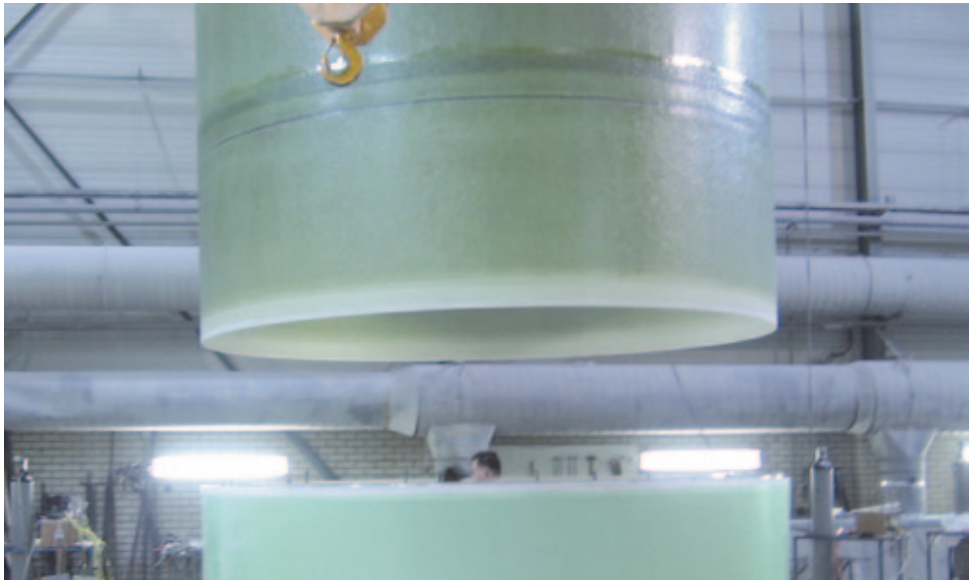
SIMONA.report

Technical Newsletter of SIMONA AG 2/2012

5 Years SIMONA.report Click here!

Maximum safety for linings and composite construction

SIMONA® Liner Materials



Preparation for joining two cylindrical sections

SIMONA offers a wide range of materials for lining the interior of steel tanks as well as for GRP composite structures. Various adhesion promoters create an optimal physical bridge between the lining and the base material to be protected against corrosion. SIMONA® Liner Materials provide a high level of operational safety and can be used for many applications – even at negative pressure.

SIMONA® Liner Materials feature a number of different properties:

SIMONA® PP-DWU AlphaPlus®-SK 1

- Alpha-nucleated polypropylene homopolymer (PP-DWU AlphaPlus®): reduced permeation through the liner due to α-crystalline modification of the homopolymeric liner component (PP-H)
- Good three-dimensional stretchability of the polyester backing (SK) under hot forming
- In applications with readily diffusing media (especially low-molecular-weight alkalis and acids) the suitability of the material must be tested by the SIMONA Technical Service Centre
- Maximum continuous service temperature (depending on application): up to 80 °C

SIMONA® PVDF-GK 2

- Higher service temperature (compared to polyester backing)
- Polyvinylidene fluoride (PVDF): excellent chemical resistance to a large number of aqueous and organic media (with the exception of highly alkaline media)
- Combination with three-dimensionally stretchable glass-fibre backing (GK) allows shaping for conventional requirements
- The adhesion promoter is largely insensitive to hydrolysis, reacts with hydrogen fluoride (acid), and at high temperatures also with hydrogen chloride (acid) and ammonia as well as derivatives thereof
- Maximum continuous service temperature (depending on application): up to 100 °C

Your contact

Achim K.E. Litzenburger
Product Manager Composite Construction, Business Unit Mobility, Life Sciences and Environmental Technology

Achim Litzenburger completed his period of studies to qualify as a Chemical Engineer (Dipl.-Ing. (FH) Chemie) at Mannheim University of Applied Sciences in 1985. In 1990, he joined SIMONA AG and initially focused on the welding of polyethylene with a high molecular weight and electrical conductivity. In addition, he was involved in providing advice on the chemical resistance of plastics, specialising in fluoroplastics and liner materials. Between 1998 and 2005 he held various posts in the plastics industry. Following his return to SIMONA in 2006 he expanded his knowledge in the field of interior linings and composite construction.

Achim Litzenburger now holds the position of Product Manager Composite Construction, a field in which he is responsible for expanding the product range and conducting research into new areas of use.

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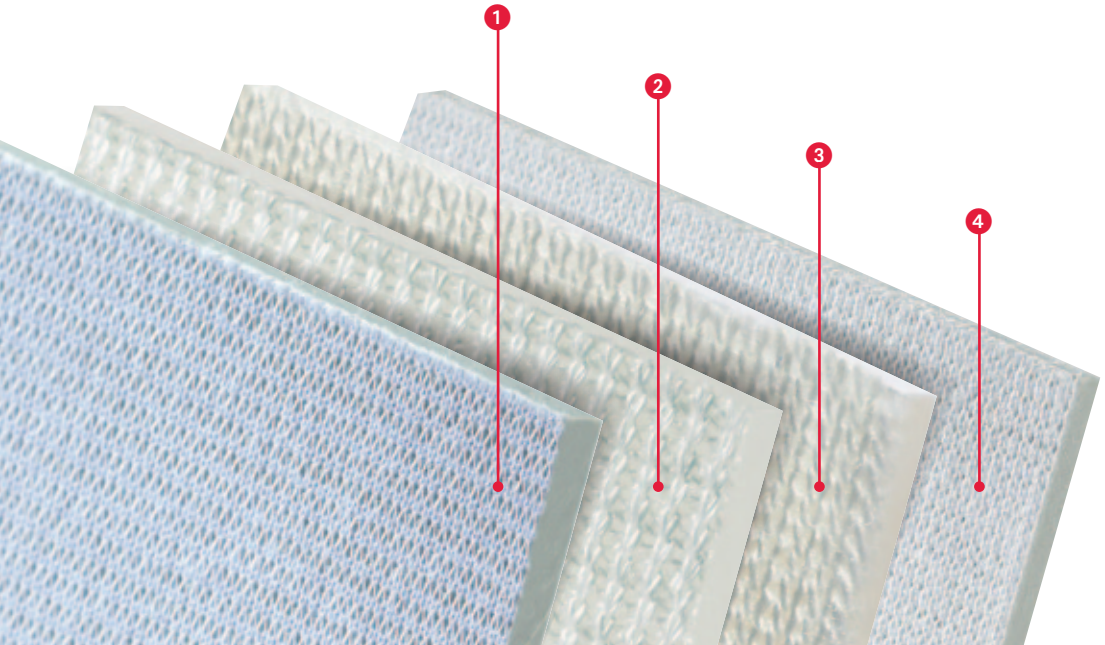
SIMONA® E-CTFE-AK 3

NEW

- Ethylene chlorotrifluoroethylene (E-CTFE): in some cases much lower diffusion sensitivity to many aqueous and organic media (in comparison with other liner materials)
- Combination with aramid backing (AK), which features good three-dimensional stretchability, allows many different types of shaping, e. g. manufacture of dished boiler ends
- In applications with readily diffusing media (especially low-molecular-weight alkalis and acids) the suitability of the material must be tested by the SIMONA Technical Service Centre
- Maximum continuous service temperature (depending on application): up to 110 °C

SIMONA® PP-C-PK 4

- Identical chemical resistance of the liner component polypropylene copolymer (PP-C) and the adhesion promoter, a polypropylene backing (PK), makes it possible to prolong service of the composite system in the case of permeating media
- Excellent three-dimensional stretchability under hot forming/thermoforming
- Backing in the seam zone does not have to be removed for welding
- Maximum continuous service temperature (depending on application): up to 90 °C



SIMONA® Liner Materials provide maximum safety for the storage and transport of chemically aggressive substances.

SIMONA® PVDF-(EL)-CV 5

- Electrically conductive polyvinylidene fluoride (PVDF-EL): applied in solventbased processes
- Option of direct lamination of pipes, which are low-stress due to thermal aftertreatment

- The chemically pretreated surface (CV) is resistant to hydrolysis and many low-molecular-weight acids and alkalis and does not have to be removed prior to welding
- The longer diffusion distance generally results in an extended service life for the composite system (compared to glass backing)
- Maximum continuous service temperature (depending on application): up to 90 °C

Achim K.E. Litzenburger
Product Manager Composite Construction

Special benefits for processing and operation

SIMONA® E-CTFE-AK for road tankers

18 m³ and 31 m³ road tankers featuring 2.3 mm SIMONA® E-CTFE-AK in a dual laminate design

SIMONA AG included the partially fluorinated plastic ethylene chlorotrifluoroethylene (E-CTFE) in its product range nearly 20 years ago.

The production of the world's first 3 mm thick strips with glass-fibre backing represented a significant milestone in the early history of this material. Nowadays, thicknesses of 0.8 mm to 4 mm are being produced by means of extrusion, in a width of 1500 mm. In line with technological advancement, the product range has been extended to include pressed sheets that are up to 50 mm thick. 2011 saw the first production and delivery of E-CTFE-AK, an aramid-backed version of this plastic, which is chiefly used as a liner material.

Why aramid?

Compared to glass-fibre backing, this synthetic backing offers a number of special benefits not only with regard to processing but also in terms of operation. The preparation of seams required for liners prior to welding proves to be easier than in the case of glass-fibre backings due to trouble-free removal of the much coarser fluff. This is complemented by reduced post-welding work normally associated with seam impurities. In the case of glass-fibre backings, the hot forming process, frequently required for so-called dished boiler ends, often goes beyond their stretchability parameters. Aramid backings, on the other hand, have better thermoforming properties. As a result, they are particularly popular in road tanker applications – with thermoformed hemispheres made of SIMONA® E-CTFE-AK.

The thermoforming efficiency of aramid-backed liners is comparable to that of polyester-backed liners. Owing to superior hydrolytic stability, however, aramid-backed liners are more durable. Consequently, aramid backing is to be recommended especially for media containing hydrofluoric acid, but it can also be used as a suitable alternative to glass-fibre backing.

Creating the GRP structure by means of filament winding (onto the liner material SIMONA® E-CTFE-AK)

When a – chiefly acid – constituent of the substance has diffused through the liner after a certain period of service, the properties of the aramid fibre come to the fore. Due to its insensitivity to stress crack corrosion, the aramid fibre can help to extend the service life (compared to the E-glass fibre normally used at pH 4 and 65 °C).

SIMONA® E-CTFE-AK has very high levels of adhesion to the substrate – glass-fibre reinforced dual laminate or interior lining. This is attributable to the high strength of the aramid fibre. As opposed to glass-fibre backing, the basic adhesive strength is sometimes lower at room temperature for production reasons. However, this is often offset or even reversed at a higher application temperature.

Other benefits compared to glass-fibre backing:

- Low application temperature of less than –20 °C
- Maximum service temperature (depending on application) of 110 °C
- Lower absorption of reaction resin/adhesive resin when coating
- Saving on consumption due to reduced thicknesses of pure resin or epoxy adhesive
- Higher bond performance during operation

Achim K.E. Litzenburger
Product Manager Composite Construction

Plastics Expertise

Partially fluorinated vs. fully fluorinated plastics

Plastics are organic macromolecules that consist of a carbon chain as their basic structure. In the simplest case, each carbon atom is attached to two hydrogen atoms, with the exception of the terminal atoms (e. g. PE, Fig. 1).

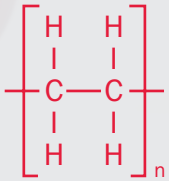


Fig. 1: *Polyolefin, e. g. PE (polyethylene)*

These hydrogen atoms can be replaced by other atoms. If some of the hydrogen atoms available are replaced by fluorine, we refer to the materials as partially fluorinated plastics (e. g. PVDF, Fig. 2).

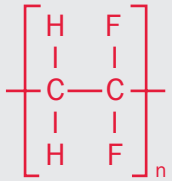


Fig. 2: *Partially fluorinated plastic, e. g. PVDF (polyvinylidene fluoride)*

If all of the hydrogen atoms in the macromolecule are replaced by fluorine, we refer to the materials as fully fluorinated plastics (e. g. PTFE, Fig. 3).

Fig. 3: *Fully fluorinated plastic, e.g. PTFE (polytetrafluoroethylene)*

By comparison, partially fluorinated plastics are stronger and are easier to process (e. g. welding) than fully fluorinated plastics. On the other hand, fully fluorinated plastics have a higher level of chemical resistance and a wider service temperature range.

Due to the elaborate manufacturing processes for partially and fully fluorinated plastics, their prices are well above those of polyolefins (e. g. PE and PP). In view of the strength characteristics and the overall cost of partially and fully fluorinated plastics, they are often used in composite structures together with other materials that provide the mechanical strength.

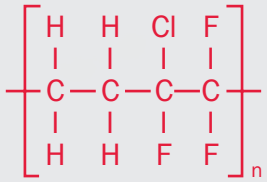
Dieter Eulitz

Product Manager Fluoropolymers

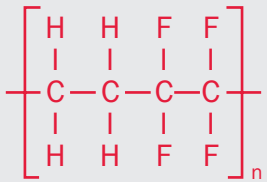
Key: ***C*** *= carbon,* ***H*** *= hydrogen,* ***F*** *= fluorine,* ***Cl*** *= chlorine*

E-CTFE vs. E-TFE – Only one atom replaced?!

The group of partially fluorinated plastics includes not only the homopolymer PVDF but also the copolymers E-CTFE and E-TFE. The difference in the structural formula of the latter two is restricted to a single atom.



E-CTFE (ethylene chlorotrifluoroethylene)



E-TFE (ethylene tetrafluoroethylene)

The two copolymers are chiefly used in composite structures with GRP (glass-fibre reinforced plastic) or steel.

The inherent properties of the polymer in conjunction with the adhesion promoter are generally considered crucial when it comes to choosing between E-CTFE and E-TFE.

The specific advantage of E-CTFE is its generally very high level of resistance to small molecules penetrating and migrating through the polymer (permeation). The service temperature range for longer-term applications is between –60 °C and +150 °C.

The more flexible, very tough E-TFE tends to be anti-adhesive (similar to Teflon). With a service temperature range of –100 °C to +155 °C, it can also be used for longer-term applications. Another property worth highlighting is its superior tolerance to high-energy radiation.

Achim K.E. Litzenburger

Product Manager Composite Construction

Material specifications

	Test method	Unit	SIMONA® E-CTFE	SIMONA® E-TFE
Density	DIN EN ISO 1183	g/cm³	1.68	1.73
Yield stress	DIN EN ISO 527	MPa	31	44
Elongation at yield	DIN EN ISO 527	%	4	8
Tensile modulus of elasticity	DIN EN ISO 527	MPa	1650	900
Notched impact strength	DIN EN ISO 179	kJ/m²	without break	without break
Shore hardness D	DIN EN ISO 868	–	74	67

Reduced weight, maximum rigidity

Outdoor whirlpool made of SIMONA® PP-C-UV Twin-Wall Sheets

Swiss-based plastics processing company Allplast AG built an outdoor whirlpool for the Solbadhotel at the Bernese Oberland tourist resort of Sigriswil in Switzerland. The pool, including fittings and piping, was made from SIMONA® PP-C-UV Twin-Wall Sheets at Allplast AG's production plant. Using a mobile crane, the pool was transported to its destination site as a ready-assembled component, where it was subsequently installed.

Initial situation

An outdoor whirlpool was to be designed and built for a wellness hotel in the Bernese Oberland. Dimensions: 7.6 m x 3.2 m. Depth: 1.10 m – 1.35 m.

Task

In order to implement the project, a financially viable solution was sought based on the following requirements:

- Light weight, maximum rigidity
- UV stability
- All-year operation at a water temperature of 35 °C
- Non-slip properties

Solution

SIMONA® Twin-Wall Sheets made of PP-C-UV with an embossed, non-slip surface were able to meet the demanding requirements. The stepped bottom of the pool stands on a concrete foundation. Therefore, no additional reinforcement was required for the twin-wall sheets. Structurally the walls are of cantilever design because supply lines as well as mechanical and electrical components have to be accessible under the walk-over wooden grating. Another challenge was to integrate the numerous massage nozzles, spotlights and valves without affecting the structural properties of the twin-wall sheets. One particularly demanding aspect was the design of the overflow channel that spa guests can walk over, as its level was only allowed a tolerance of less than 2 mm over the entire area. This specification was achieved with precision-shaped vertical supports made of SIMONA® PP-DWU AlphaPlus®, reinforced with stainless steel tubing. The supports, which were also welded to the outer walls, thus stiffen the pool walls at the same time. Owing to the high rigidity and extremely low weight, both transport and installation of the pool went smoothly.

Construction and completion at Allplast AG

Transport by mobile crane

Outdoor whirlpool in operation

SIMONA® PP-C-UV-HKP

Properties
- Light weight
- Excellent chemical resistance
- Outstanding fabrication capability
- High strength
- High fracture resistance
- Resistance to microorganisms

Fields of application
- Tank construction
- Safety drip pans
- Sound and weather protection booths
- Swimming pool construction

Product range
- Sheets made of PE, PP, PPs or PP-C-UV in various formats with variable web spacing and different sheet thicknesses
- Corner elements
- Flat connections

Five years of SIMONA.report – our Technical Newsletter celebrates its anniversary

Reader survey – Make SIMONA.report even better

SIMONA AG's very first Technical Newsletter was launched in October 2007. Since then fifteen issues have been published in eight languages, i.e. over 12,000 newsletters have been sent out in total.

SIMONA.report appears 2-3 times a year – simply registering on the website is all it takes to receive an e-mail containing a preview of topics and a download link directly after publication of the current issue. The content of the newsletter ranges from technical articles featuring specific product information to practical case studies. Owing to the high level of interest in our newsletter, we publish SIMONA.report in German, English, French, Spanish, Italian, Polish, Czech and Russian. With more than 1,500 active subscribers, SIMONA.report has evolved over the last five years to become an acknowledged source of information.

Rather than resting on our laurels, we are committed to improving our Newsletter continuously – with your help. For this purpose, it is essential that we acquire as much information as possible about your reading habits and your wishes, interests and suggestions for improvement. That is why we would like you to participate in the following reader survey. The survey consists of nine short questions and is conducted anonymously. Thank you very much in advance for participating.

Help us to make SIMONA.report even better. Participate in the reader survey.

Start here!

Imprint

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