agru

The Plastics Experts.

SEMI-FINISHED PRODUCTS

FOR EXTREME APPLICATIONS
PE, PP, PVDF, ECTFE, FEP, PFA

EN

The Plastics Experts.

The AGRU success story already spans seven decades. Founded in 1948 by Alois Gruber sen., the company is now counted among the most important comprehensive suppliers for piping systems, semi-finished products, concrete protective liners and geomembranes made of engineering plastics. The fact that we provide everything as a single source supplier distinguishes us from many competitors. We process exclusively high-quality thermoplastic materials. And when it comes to problem-solving expertise for material selection and installation, we are your best partner.

Universal scope of applications

AGRU semi-finished products made of thermoplastics are an excellent and durable solution for modern, premium apparatus and tank construction, and for manufacturing wear-resistant products. In the chemical and heavy industries, and in plant construction. A variety of requirements exist for semi-finished products in terms of acid and alkali resistance, application temperature and low static charge in areas with a risk of explosion. Users can work with various processing methods, including diverse proven joining technologies such as extrusion welding, hot gas welding, and butt welding. Customer satisfaction is the first priority for AGRU. Technical consultation, seminars, welding training and expert on-site instruction form the foundation for achieving this.

Quality

AGRU maintains a quality management system according to the ISO 9001:2015 standard, as well as an environmental management system according to the ISO 14001:2015 standard and the safety and health management system according to the ISO 45001:2018 standard. Additionally the products comply with international standards and are monitored and evaluated by independent testing agencies on a regular basis.

The start-to-finish attention to quality ensures that the products meet the strictest technical specifications and ensure the safe operation of equipment and tanks. Several AGRU Semi-finished products comply with the EU-Regulations No. 10/2011 on plastic materials and articles intended to come in contact with food.

SEMI-FINISHED PRODUCTS Chemical-resistant sheets, pipes, bars, and welding rods

The semi-finished products made of thermoplastic materials from AGRU are distinguished by their high acid and alkali resistance. This results in lower life cycle costs due to extended maintenance intervals and the long service life of the products. Our comprehensive programme of semi-finished products provides solutions for a temperature range from -190 °C to +260 °C. Consistent high quality ensures the reliability and long service life of all our components.

Highest media resistance

A stable polymer is for each chemical application available

Optimised price-performance ratio for each application
- thanks to consultation and material recommendations by The Plastics Experts
- due to the operational reliability provided by AGRU solutions
- resulting from longer-than-average service lifetime

One stop shopping

Comprehensive semi-finished product portfolio and extensive stock-keeping

Since all semi-finished products are manufactured in-house, we can
- deliver a broad range of products for diverse applications
- fabricate custom parts for specific customer needs
- process special materials (flame retardant, electrically conductive)

Consistently high quality

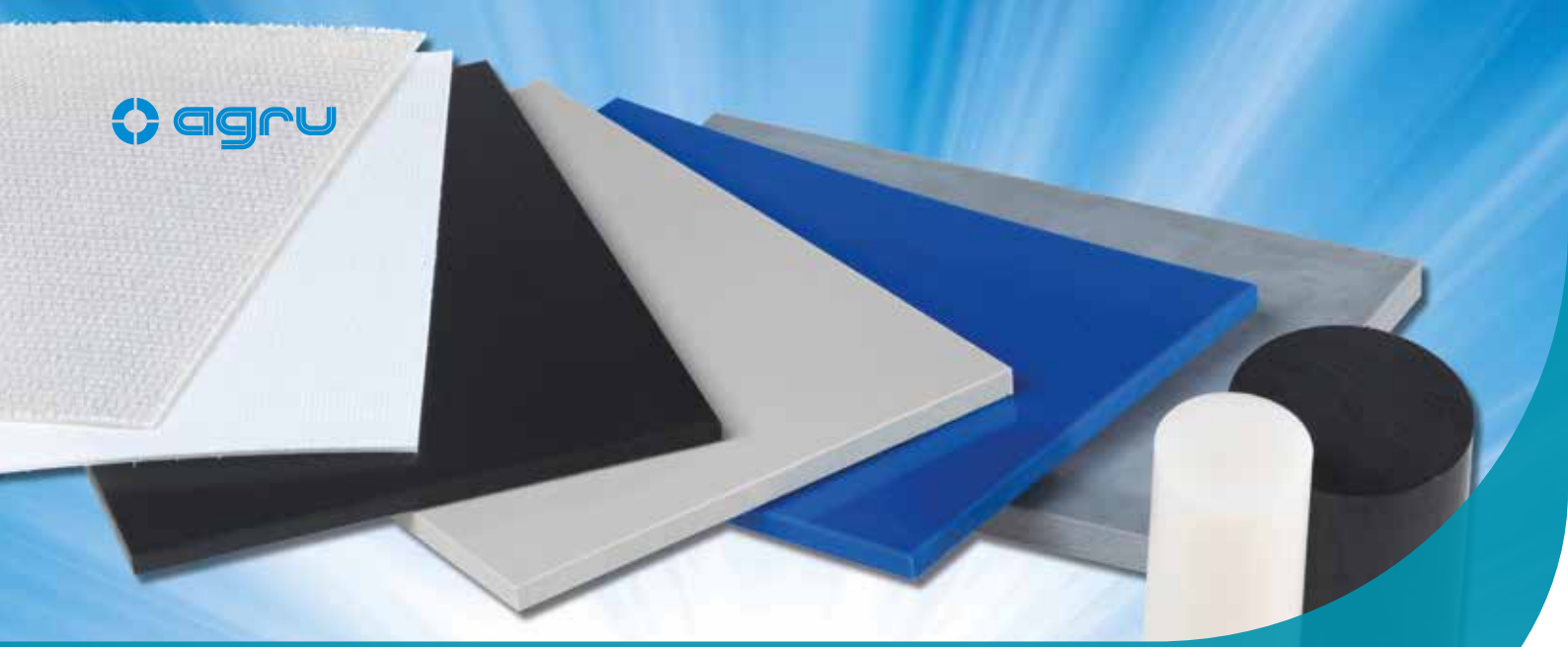
Raw material specifications, cutting-edge production & quality assurance

Reliable products with consistent properties
- monitored by ISO-certified quality and environmental management systems
- due to conformity to national and international standards
- ensured by regular audits and external monitoring

Fabric backings

Chemically resistant fabrics made of various materials (polyester-, synthetic- and glass fabric)

We provide the optimal long-lasting solution for each application
- through our production including PE, PP, PVDF, ECTFE, FEP, and PFA fabric backed sheets
- thanks to the high acid and high hydrolysis resistance of the synthetic fabric
- due to easy handling provided by thermoformability
- because AGRU utilises a proven method for the embedding of the fabrics in the plastic material



SEMI-FINISHED PRODUCTS
Sheets, round bars, and welding rods

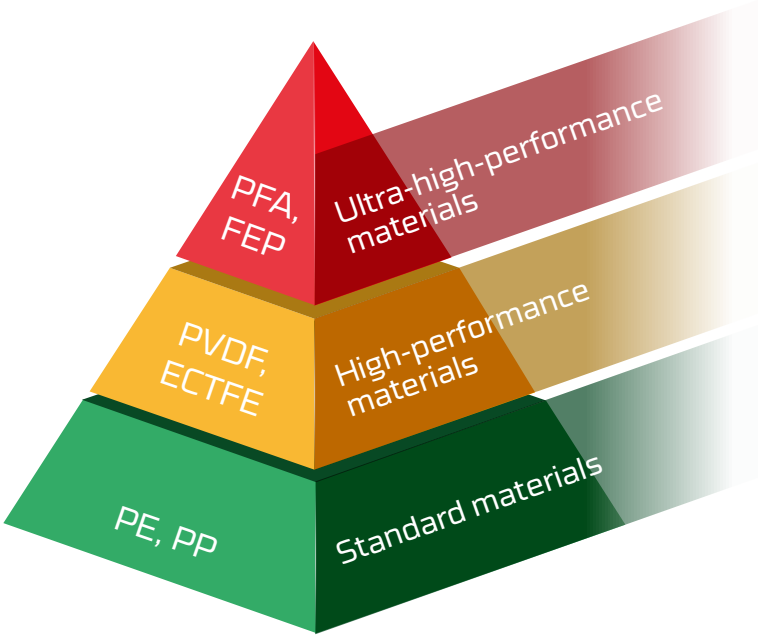
Semi-finished products made of thermoplastics are an excellent and durable solution for modern, high-quality apparatus and tank construction, and also for manufacturing wear-resistant products. In the chemical and heavy industries, and in plant construction, a variety of material requirements exist. These include resistance to acids and lyes, resistance in a wide temperature range, low static charging in potentially explosive atmospheres (ATEX) and many other demands.

The AGRU product range is distinguished by a unique variety of products and materials. All our sheets, round bars, welding rods, and liner pipes are available in everything, from standard up to high-performance plastics. Solutions and finished parts for any application can be realized with our pressed and extruded sheets, fabric backed sheets, round bars and hollow bars, fabric backed pipes, and welding rods made of PE, PP, PVDF, ECTFE, FEP, and PFA. In addition to our standard portfolio, many specialised products are also available upon request.

DVS codes provide information about established joining methods and welding parameters. Users can choose from various proven methods, such as extrusion welding, hot-gas welding and butt welding. Also for machining, thermoforming and tank constructions established procedures are available.

AGRU material pyramid

The respective industrial application determines which material provides the optimal cost-effectiveness and operational reliability. The Plastics Experts will help you selecting the best polymer for your application. AGRU semi-finished products made of PFA and FEP are resistant to even the most aggressive media, meaning that almost every corrosion problem can be solved.



Polyethylene

Since 2019 AGRU is producing Semi-finished products made of PE 100-RC black as a standard. PE 100-RC is characterized by high toughness and very good chemical resistance, and can be used from -40 °C to +60 °C. Other characteristics of semi-finished products made of PE 100-RC black include the following:

- good resistance to wear
- very good electrical insulation
- high vibration damping

For decades now, semi-finished products made of PE 100 and PE 100-RC black have proven to be reliable when used outdoors. The addition of special carbon black types (approx. 2 %) ensures light and weather resistance. Semi-finished products made of PE 100-RC black are unaffected by natural UV radiation.

The development of polyethylene materials and their use as material for semi-finished products has reached its current peak with a design stress (minimum strength) of 10 N/mm² in terms of mechanical stress resistance. In recent years, further development has focused on „resistance to stress cracking". These raw materials are referred as „PE 100-RC". The development of the PE 100 type into a „RC" material is not only being used in benefiting the pressure pipe sector, but also tank construction.

The main technical advantage of PE 100-RC is that it is significantly more resistant to crack growth. This is reflected by the failure time measured by the FNCT („full notch creep test"), which is >8760 h compared to 300 h for PE 100 materials. Semi-finished products made of PE 100-RC materials therefore exhibit significant advantages for applications with media that cause stress cracks. As a result, it is possible to develop new applications involving PE 100-RC and to increase the service life considerably. Furthermore expensive materials can be avoided.

Electrically conductive polyethylene (HDPE-el ESD) is a material that conducts electrical charges, because conductive particles (carbon black) have been added. Semi-finished products made of this special material have integrated stabilisers that counteract the effects of natural UV light and are therefore also suitable for outdoor applications. Due to their special electrical properties, these semi-finished products are particularly well suited for transporting highly flammable media or dusts. HDPE-el ESD can also be used in areas where sparking from electrostatic charging needs to be prevented due to explosion protection requirements.

To comply with purity requirements, AGRU offers sheets made of **natural** HDPE as well.

	PE 100 black [mm]	PE 100-RC black [mm]	HDPE natural [mm]	HDPE-el ESD black [mm]
Extruded sheets				
2000 x 1000		2 - 40	3 - 10	3 - 20
3000 x 1500		3 - 50	3 - 25	5 - 15
4000 x 2000		3 - 40		
Pressed sheets				
2000 x 1000		10 - 120	10 - 80	25 - 60
4000 x 2000		15 - 60	15 - 60	
Polyester fabric-backed sheets				
3000 x 1500		4 - 5		
Round bar		15 - 640		50 - 160
Welding rod round, 3 kg roll	3 - 5	3 - 5	3 - 4	3 - 4
Welding rod round, 10 kg roll	3 - 5			
Welding rod triangular rounded, 3 kg roll	5 x 3			

Other dimensions available on request

Polypropylene

Polypropylene (PP) is a semi crystalline thermoplastic similar to HDPE, but with higher stiffness, strength, and hardness levels. It is also characterised by a very good chemical resistance. Polypropylene can be used in temperatures up to 95 °C. However, below freezing point PP is very sensitive to impact (outside temperatures below - 5 °C should be avoided). Semi-finished products made of PP are also characterized by the following:

- a low density of 0.91 g/cm^3
- relatively high surface hardness
- electrical insulation properties
- high creep strength

PP is the ideal material for the use in pickling plants, the chemical industry, and also for extremely aggressive waste water, as chemicals are used at high temperatures in these areas. The AGRU product range includes various PP polymer types:

- PP homopolymer (PP-H), which is made up exclusively of propylene molecules.
- PP random copolymers (PP-R), a polypropylene in which statistically distributed ethylene monomers are integrated into the molecular chain.
- PP copolymer (PP-C, PP-B), a polypropylene block copolymer in which ethylene monomers in block form are integrated into the molecular chain.

All three polypropylene types are thermally stable, perfectly compatible, and can be easily welded by all standard welding procedures according to DVS 2207. Semi-finished products made of grey polypropylene are not UV-stabilised and therefore need to be protected accordingly.

Low-flammability polypropylene (PPs) is a PP homopolymer, which is equipped with a flame retardant. Consequently, PPs can be classified as a material with higher flame resistance according to DIN 4102 and UL94. **Low-flammability and electrically conductive** (PPs-el ESD) polypropylene is made of PP copolymer and is equipped with both flame-resistant and electrically conductive / anti-static properties. The surface resistance is ≤10^6 Ohm, which means that electrostatic charging is prevented. Semi-finished products made of polypropylene **natural** and **white** (made of PP-H) complete our extensive range of PP semi-finished products.

	PP-H grey RAL 7032 [mm]	PP-R grey RAL 7032 [mm]	PP-C (B) grey RAL 7032 [mm]	PP natural [mm]	PP white [mm]	PPs grey RAL 7037 [mm]	PPs-el black [mm]
Blocks							
1000 x 620		40 - 120					
Extruded sheets							
2000 x 1000	1 - 40			2 - 6		3 - 10	3 - 20
3000 x 1500	3 - 40		3 - 20	8 - 25	6 - 20	3 - 20	4 - 15
4000 x 2000	3 - 40	40 - 50					
Pressed sheets							
2000 x 1000	10 - 60	70 - 120		10 - 60		25 - 40	
4000 x 2000	15 - 60			15 - 60			
Polyester fabric-backed sheets							
3000 x 1500	3 - 6						
25000 x 1500	3 - 4						
Glass fabric-backed sheets							
3000 x 1500		5					
Round bar		15 - 640			70 - 150		20 - 100
Welding rod round, 3 kg roll	3 - 5	3 - 5	3 - 4	3 - 4	3 - 4	3 - 4	3 - 4
Welding rod round, 10 kg roll	3 - 4						
Welding rod round, 1 m bar	3 - 4						
Welding rod triangular rounded, 3 kg roll	5 x 3 / 6 x 4					5 x 3	
Welding rod oval, 3 kg roll	5 x 3 / 6 x 4						

Other dimensions available on request

Fluoropolymers (PVDF, ECTFE, FEP, and PFA)

Highest corrosion resistance in the plastics sector

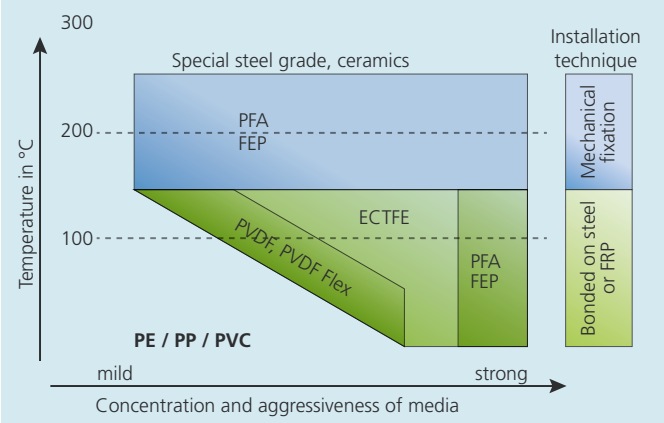
Depending on the application temperature, media and concentration, a number of fluoropolymers are available. These can be used as structural materials or as corrosion protection lining. In addition to the polymer, the type of installation plays a role in determining the maximum operating conditions.

Almost unlimited chemical resistance

- thanks to partially and fully fluorinated materials
- fluorination provides extremely high corrosion resistance
- for each kind of chemical, we have the ideal material

Developed for extreme temperatures

- outstanding temperature stability between -190 °C and +260 °C
- excellent low-temperature flexibility
- exceptional weathering resistance and resistance to sunlight



Ideal for high-purity applications

The minimal leach out behaviour of PVDF and PFA is achieved by using carefully selected raw material and optimised production processes. Semi-finished products from AGRU are therefore ideal for applications with ultrapure water and highly purified chemicals, and for cleanroom use.

Self-cleaning surfaces

Fluoropolymers are distinguished by their extremely low surface tension and thus their antiadhesive qualities. As a result of their surface tension, fluids have the tendency to minimise their surface area and try to revert to a spherical shape. They therefore pearl off the hydrophobic surface of fluoropolymers, taking dirt particles with them. This makes it possible to empty tanks and pipework with a minium of residues, which ensures an easy cleaning process.

High-end materials
Product range

PVDF

AGRU PVDF is a highly crystalline, non-reinforced plastic that combines good mechanical, thermal, and electrical properties with an excellent chemical resistance. In addition, it possesses good radiation resistance, which makes it ideal for high-end applications in the semiconductor, pharmaceutical, life science, and photovoltaic industry.

PVDF can be processed without additives, which gives it excellent leach out behaviour. PVDF is manufactured under controlled purity conditions using carefully selected raw materials. Areas of application for these products include pipeline systems, storage and transportation tanks, and apparatuses requiring high media purity and leaching behaviour standards.

PVDF can be equipped with electrically conductive particles especially for the electrical industry and explosion-proof areas. The conductive PVDF-el ESD (electrically conductive or electrostatic discharge) can be manufactured in sheets, rods, pipes, and welding rods and has a lower surface resistance, which in turn prevents electrostatic charging.

PVDF Flex is an excellent alternative to well-known, conventional fluoropolymers. When it comes to processing, important rationalisation effects can be achieved through increased flexibility, especially in the case of bonded to steel linings, but also in the case of confined spaces or small radii.

	PVDF [mm]	PVDF - Flex [mm]	PVDF-el ESD [mm]
Extruded blocks			
1000 x 610	10 - 100		
Extruded sheets			
2000 x 1000	2 - 20		
2440 x 1220	3.18 - 25.4		
3000 x 1500	3 - 10		3 - 8
Pressed sheets			
2000 x 1000	10 - 40		10 - 40
Polyester fabric-backed sheets			
2000 x 1000	2 - 5		
3000 x 1500	3 - 4		
25000 x 1000	2 - 3		
25000 x 1500	2 - 4		
Fabric backed sheets SK+			
3000 x 1500	3 - 4	2.3	3 - 4
10000 x 1500	3 - 4	2.3	
Round bar	10 - 340		20 - 200
Hollow rod	25 - 45		
Welding rod round	3 - 4	3 - 4	3 - 4
Welding rod triangular	5 x 3		
Pipe (5 m)			32 - 250
HV-Liner			
Pipe (5 m)	20 - 400		32 - 250
Bend	20 - 200		
Tee	20 - 200		
Reducer	63 - 160		

Other dimensions available on request

ECTFE

ECTFE possesses a unique combination of properties that are the result of its chemical structure, which consists of a copolymer with ethylene and chlorotrifluoroethylene arranged alternately. ECTFE demonstrates excellent resistance to the corrosive influence of heat, strong radiation, and weathering. The material has high impact resistance and shows almost no property changes in a wide temperature range, making it particularly well-suited for demanding industrial applications. Furthermore ECTFE is known for its good permeation barrier for many chemicals. Its excellent welding properties and thermoplastic formability also make simple and cost-saving processing possible, both in the workshop and on-site. Compared to PVDF, ECTFE has a better chemical resistance, especially when exposed to lyes.

	ECTFE [mm]
Extruded sheets	
2000 x 1250	4 - 15
2440 x 1220	3.18 - 25.4
3000 x 1500	2.3 - 3
Pressed sheets	
2000 x 1000	10 - 40
Fabric backed sheets SK+	
3000 x 1500	2.3 - 3
15000 x 1500	2.3 - 3
Glass fabric backed sheets GGS	
3000 x 1500	2.3 - 3
15000 x 1500	2.3 - 3
Round bars	20 - 100
Welding rod round	3 - 4
Pipes SK+ (1 m / 5 m)	20 - 160

Other dimensions available on request

FEP

FEP, which is a fully fluorinated thermoplastic, offers outstanding corrosion resistance. It performs reliably over the enormous range of temperatures between -190 °C and +205 °C, and can therefore be used in numerous industrial applications. Flexibility, thermoformability and optimal welding properties ensure that AGRU FEP products can be manufactured reliably at low costs.

	FEP [mm]
Extruded sheets	
10000 x 1250	2.3
15000 x 1250	1.5
Glass fabric-backed sheets GGS	
2000 x 1250	0.8 - 2.3
10000 x 1250	2.3
15000 x 1250	1.5
Welding rod round	3.5 - 4
Pipes (5 m)	32 - 160
Pipes GGS (1 m / 5 m)	32 - 160

Other dimensions available on request

PFA

PFA is the highest grade plastic in the AGRU portfolio. It is suitable for an extremely broad spectrum of applications, thanks to its resistance to almost any medium and its temperature range of -190 °C to +260 °C. This means it can be offered as a solution even for extreme chemicals at high temperatures. The products made of PFA are also available in HP (High Purity) quality. HP quality means it can be used for applications in the semiconductor, pharmaceutical, and food industries that require high purity levels.

	PFA [mm]	PFA HP [mm]
Extruded sheets		
20000 x 1250	1.5	
10000 x 1250	2.3	
2000 x 1250	2.3 - 10	4 - 10
2000 x 1150	15 - 20	15 - 20
Glass fabric-backed sheets GGS		
2000 x 1250	0.8 - 2.3	
10000 x 1250	1.5 - 2.3	2.3
Round bars	20 - 100	
Welding rod round		3.5 - 4
Pipes (5 m)	32 - 110	
Pipes GGS (1 m / 5 m)	32 - 110	

Other dimensions available on request

Even thicker machined due to extruded blocks

Extruded blocks

Especially for the production of special machined parts, AGRU can now manufacture blocks with a thickness of up to 120 mm in addition to solid bars and press sheets. Usually, thick components are manufactured in one pressing process, but the new AGRU blocks are produced in a continuous extrusion process. The typical applications of thick blocks are mainly in the mechanical production of special parts, which are used in industry and in container, apparatus and pipeline construction.

	PP-R GREY	PVDF NATURAL	PE TYPES
Blocks 1000 x 620 mm Thickness [mm]	40 - 120 mm		40 - 120 mm (on request)
Blocks 1000 x 610 mm Thickness [mm]		10 - 100 mm	

Other dimensions (up to 3000 mm length), types (PP-RCT, PE-el, PE 100-RC) and colors (black, white, natural) on request.

All product details in one view

- Extruded blocks in PP-R and PVDF up to 100 mm thickness available from stock
- Standard format of blocks 1000 mm x 610 mm (PVDF) or 1000 mm x 620 mm (PP-R)
- Special lengths up to 3000 mm possible
- Cost-effective manufacturing of special parts
- PE types and other special materials and colors available on request

Custom tailored solutions

Technical application consultation

Often it's nothing more than an idea on a piece of paper brought to us by a customer that AGRU's expertise in plastics technology turns into reality. AGRU design teams are constantly working on the realisation of customer wishes. Ultimately, the economic efficiency and technical feasibility is determined by the choice of material, since it must fully meet all the requirements in the areas of chemical resistance, temperature stability as well as physical durability. That's why the selection of the optimal material for the specific requirements of an application is one of AGRU's core competencies. Thanks to the extensive experience of our application engineers at AGRU, we create custom-tailored solutions that are perfectly adapted to the operating conditions.

Machining expertise

Whether in the construction business or for semiconductor production: Intelligently machined plastic parts from AGRU are used everywhere. A key factor for success is certainly the seamless process chain, consisting of our own fabrication with numerous technologies found in-house and our worldwide logistics capabilities. With the combination of expertise, automated technology, and careful manual craftsmanship, we engineer products that are among the best in the industry. The necessary drilling, turning, milling and welding operations are done on state-of-the-art machining centres.

In direct collaboration with our customers, we create state-of-the-art plastic solutions that reflect the latest technological developments in design, functionality and economic efficiency.

Applications

Plant construction

AGRU semi-finished products are ideal construction materials for custom-built equipment. Because they are low in weight and easy to process, it is possible to realise very complex geometrical forms with them.

Tank construction

Tanks for different chemicals can be made quickly and reliably using AGRU semi-finished products. The comprehensive product range offered by AGRU provides significant advantages, because in addition to semi-finished products, pipes and diverse fittings are also used to construct a complete overall system. The operating conditions, such as the chemicals and temperatures involved, also play a significant role in the process.

The advantages of an AGRU solution are obvious:

- low tank weight in comparison to steel
- high chemical resistance
- easy processing of the semi-finished products
- variety of materials

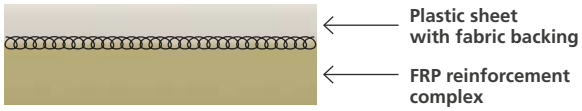
Finished parts

As a leading company in the plastics industry, AGRU manufactures semi-finished products and also machines them as needed to create a final product. Much expertise has been gathered, in particular in the area of special parts for piping systems. Thus AGRU fabricates fittings up to an outer diameter of 2500 mm in its own CNC machining department.

Lining material

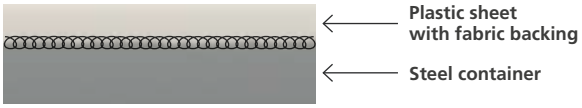
FRP dual laminate

Tanks made of fibre-reinforced plastic (FRP) are lined with fabric backed sheets to maintain chemical resistance and leak-tightness. Such tanks, boilers, reactors, and scrubbers are then suitable for operation under vacuum and pressure up to 180 °C (depending on material and chemical).



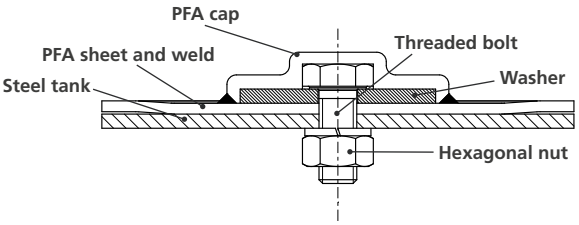
Steel lining (fully bonded)

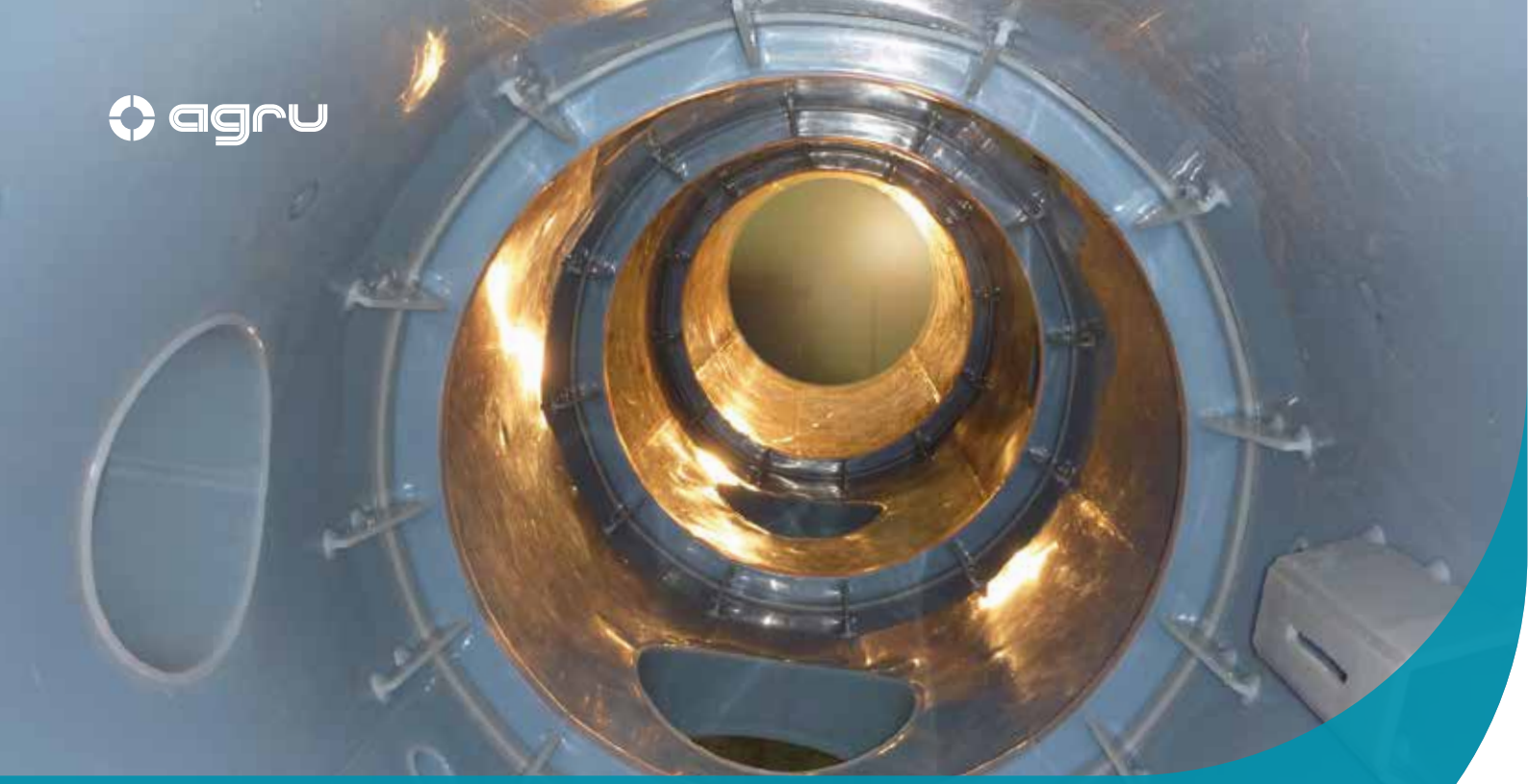
A fully bonded lining made of fabric backed sheet materials applied to steel provides a long-term chemical resistance at temperatures up to 120 °C (depending on material and chemcial) for storage and shipping containers, reactors, centrifuges and related equipment.



Fixpoint lining

AGRU PFA sheets can be fastened to steel tanks by using mechanical fix points such as clamps, bolts, or screws. This PFA lining system is mainly used for flue gas applications and desulphurization systems at temperatures up to 260 °C.





Fabric backing systems

Excellent bonding with steel tanks and fibre-reinforced plastics

The great variety of materials (PE, PP, PVDF, ECTFE, FEP, and PFA) as well as different backing systems (polyester, glass, synthetics) make it possible to realise solutions in a wide temperature range. We always have the best material for the respective task, whether for lining steel tanks or for dual-laminate constructions. The decisive factors for linings are the choice of fabric and the bond achieved between the plastic and as well as the bond with the FRP or steel tank surface.

- optimised price-performance ratio for each application and long-lasting solutions thanks to acid-resistant fabrics made of different materials
- easy handling due to the thermoformability of the fabrics
- consistent fabric backing quality and optimal bonding between fabric and plastic thanks to proven fabrication processes

SHEET MATERIAL		PROPERTIES
Polyester fabric		• most economical and proven solution • available for PE, PP, and PVDF
GGS **Glass fabric**		• available for all materials • extreme temperature stability • good thermoformability • good bonding strength
SK+ **Optimised** **synthetic fabric**		• very high hydrolysis resistance • top resistance against acids • high bonding strength at high operating temperatures • available for PVDF and ECTFE

HV-Liners and fabric backed pipes

Custom-tailored piping systems for any application

AGRU offers special liner pipes for FRP applications. Whilst the FRP structure provides the necessary stiffness, the liner pipe provides the chemical resistance for the application. That way custom-tailored pipes can be produced for any application:

- high bonding strength between the laminate and the FRP-resin system (DIN 16964) > 5 N/mm²
- flangeless FRP pipe connections minimise maintenance costs
- low weight of the entire piping system
- saves material costs compared to solid-wall piping

HV-Liner

The PVDF HV-Liner from AGRU is an economical alternative to traditional fabric backed pipes. The surface-treated PVDF pipe has a three-dimensional surface structure which provides an optimal bonding to the FRP structure. The piping systems are available in PVDF, PVDF-FLEX, and PVDF-el ESD. The pipes can be produced in diameters from 20 – 400 mm.

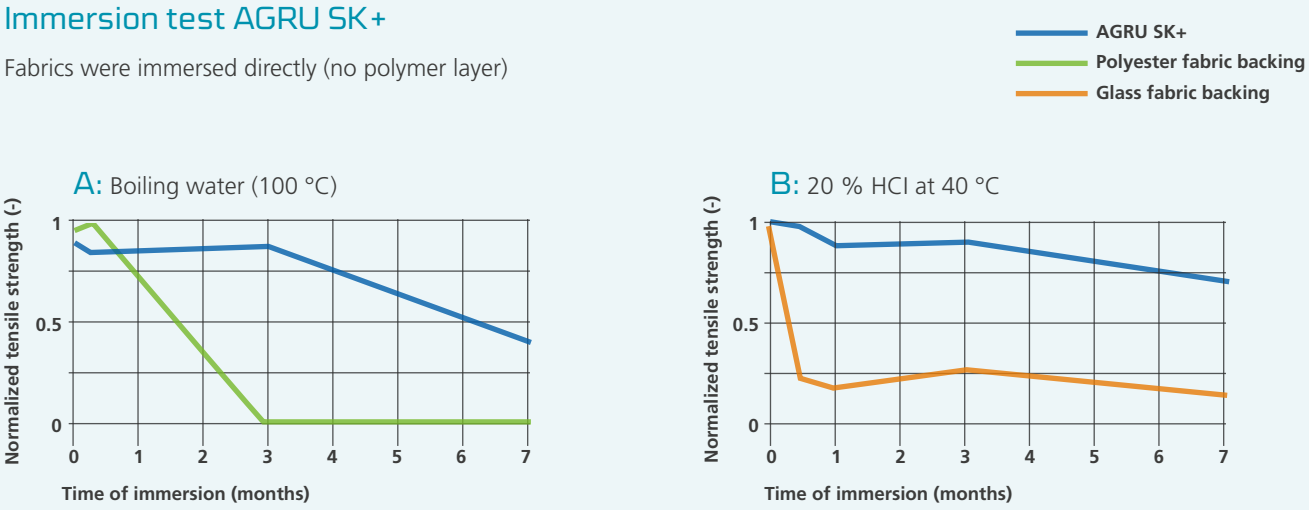
AGRU is now able to apply the special surface treatment of the pipes also to injection moulded fittings (OD 20 - 200 mm).

SK+ and GGS laminated pipes

The fabric backed pipings are available in ECTFE, FEP and PFA. AGRU GGS glass fabrics are the standard for FEP and PFA. For ECTFE, SK+ is the preferred solution.

Immersion test AGRU SK+

Fabrics were immersed directly (no polymer layer)



The Plastics Experts.

Your distributor

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