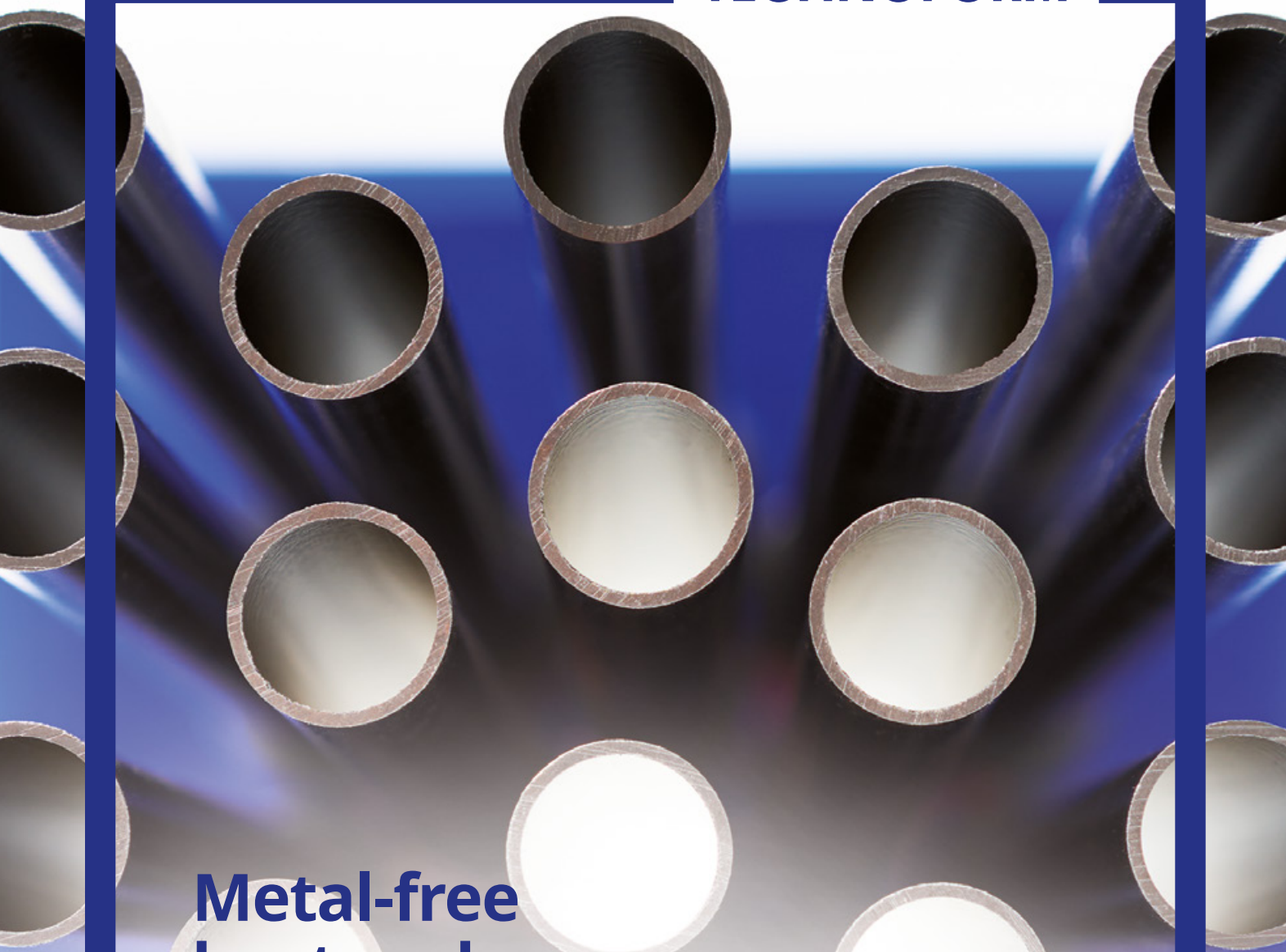
TECHNOFORM



Metal-free heat exchanger solutions

Metal substitution with thermoplastics

Tailored plastic profile solutions

Enhancing industrial applications by means of plastic heat exchanger solutions

Heat transfer equipment is used in a wide range of industrial applications.

Metal substitution with thermoplastics

Technical plastic heat exchanger solutions

Many industries are dependent on heat transfer equipment in their production processes. It´s used to cool or heat media, condense or vaporize, recover heat and clean waste water or flue gas.

During this wide field of applications, heat transfer equipment is often exposed to rather aggressive substances like acids, bases or brines in high concentrations.

Nevertheless, the majority of users still relies on heat exchangers made of metal, although it´s common sense, that metal and aggressive media are not very well compatible.

This causes some generally known negative effects:

frequent maintenance due to **corrosion**

the need for **expensive metals or costly produced ceramic parts**

fast decreasing efficiency caused by f**ouling and scaling**

Today however, the development of heat-conductive polymers shows new potential for replacing metals in heat exchanger applications. With the introduction of our technical plastic heat exchanger solution, it is possible to eliminate the adverse effects previously mentioned, thereby considerably enhancing plant performance.

Any form of thermal exchange in aggressive media can profit from polymer heat exchangers.

Not metal, but ...

Polymer graphite the material of choice!

Conductive: Heat conductivity similar to metal

Traditionally, plastic profiles have only been known as excellent thermally insulating components.

But now, thanks to our innovation, using highly conductive graphite as a filler is offering a new set of dimensions for heat conduction applications, such as heat exchangers for example.

This polymer-graphite combination is able to achieve heat conductivity values similar to stainless steel or titanium.

Robust:

Burst strength up to 40 bar (580 psi)*, heat resistance from -100 °C (-148 °F) to +200 °C (392 °F)

Plastics in general have a wide range of mechanical properties and can be adapted to meet various requirements.

For example, the Young's modulus can be adapted within a range from 500 to 45000 MPa. It is possible to achieve a maximum tensile strength of up to 330 MPa. The softening point temperature may be as high as 350 °C (662 °F) (under a 261 psi load).

* 1.25 mm (0.05 in) wall, 24 mm (0.94 in) diameter extruded PPS-GR tube

Resistant:

Chemical resistance even against highly concentrated acids and bases

Plastics are widely used in the chemical industry to store or to transport highly concentrated acids or bases.

Based on that knowledge and long experience, it´s reasonable to rely on the use of these kinds of materials for applications subjected to corrosive environments.

Smooth surface:

Almost zero fouling and scaling

Our high-precision extrusion process enables us to process compounds with very high concentrations of fillers, while keeping the surface of the profiles or tubes very smooth. This smooth surface results in a much better resistance to fouling/scaling because there are no voids or surface defects for particles to adhere to.

Extensive evaporation tests have shown that the typical scaling in wastewater applications of magnesium and silica is under a detectable value using PPS graphite tubes.

Designed to resist and to perform

All variations of our metal-free heat exchanger tubes are based on high concentrations of thermally conductive filler (like graphite) combined with a thermoplastic polymer to form the shape of the tube or profile.

These polymers differ in mechanical and chemical properties – as well as in their cost level. It´s always a question of the set of requirements, to find the best fitting and most valuable combination. No matter which combination one chooses, what all polymers have in common is generally the good resistance against aggressive chemicals.

Chemical resistance of thermoplastic polymers vs. metals

Medium	Polymer graphite			Metal			
	PP-GR	PPS-GR	PEEK-GR	AluAlloy 5052	Alubrass C68700	Stainless Steel 316 L	Titanium
Seawater 3,5 % 60 °C (140 °F)	+	+	+	+	+	+	+
Seawater 3,5 % 80 °C (176 °F)	+	+	+	•	•	•	+
Saltwater >10 % 80 °C (176 °F)	+	+	+	-	•	•	+
Hydrochloric acid 2 % (HCl)	+	+	+	•	•	+	+
Hydrochloric acid conc. 36 %	+	•	+	-	-	-	•
Sulfuric acid 2 % (H2SO4)	+	+	+	•	•	•	+
Sulfuric acid (80 %)	+	+	•	-	-	-	•
Phosphoric acid, 10 % (H2PO3)	+	+	+	-	•	•	+
Phosphoric acid, concentrated hot	+	+	+	-	-	-	•
Hydrofluoric acid 40 % (HF)	+	+	-	-	-	-	-
Ferric chloride (CL2Fe)	+	+	+	-	-	-	+
Hydrogen sulfide (H2S wet)	+	+	+	•	-	•	+
Ammonium phosphate di-basic (NH4)2HPO4	+	+	+	•	-	•	+

+ resistant • moderately resistant - not resistant

Additional benefits

Proven chemical resistance

The resistance of PPS against phosphoric acid is indicated as „resistant“ in literature. Since this statement only refers to a temperature of 80 °C (176 °F) and a customer's application will reach much higher temperatures, we have developed a test in which we expose profile samples of PPS-GR to boiling phosphoric acid at 158 °C (316 °F) at a maximum acid concentration of 85 % in the long term.

We were able to confirm resistance even under these extreme conditions in this test.

Lifetime 50+ years

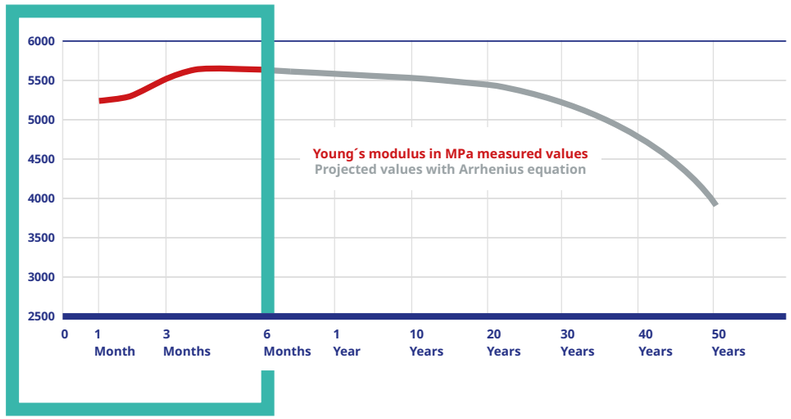
Intensive tests were carried out by the Polymer Service Institute in Merseburg (Germany) to determine the long-term behavior of the plastic tubes under operating conditions.

This test was performed with PP instead of PPS as base polymer. Since PP has a lower strength than PPS, we can conclude a much higher level of durability for PPS.

Common accelerated ageing testing methods at 80 °C (176 °F) (which is the maximum temperature value in the MED process) were applied. Values were measured over the course of six months, supplemented by measurements performed within the scope of an additional rapid ageing test and future projections using the Arrhenius equation.

Conclusion: it takes more than 50 years before the Flexural-Modulus drops below 50 % of its initial value.

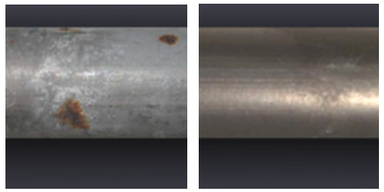
Lifespan



Additional benefits

Fouling and scaling effects

Heat exchanger tube made of duplex metal and PPS graphite after only 50 hours fouling-resistant test with industrial process water.



Duplex metal tube

PPS graphite tube

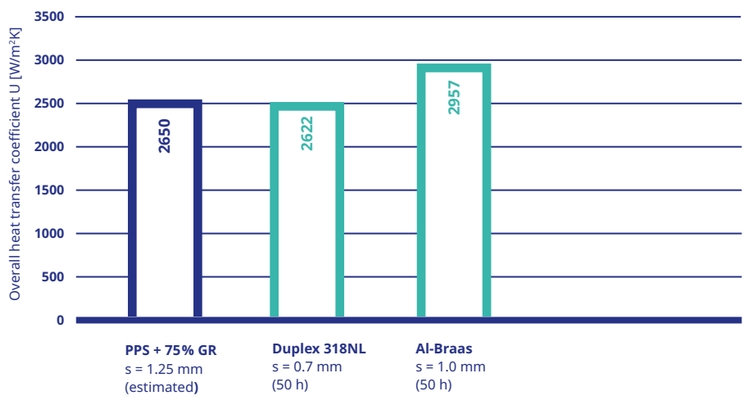
Heat exchanger tubes made of PPS graphite outperform duplex metal pipes in heat conductivity after only 50 hours in the evaporation test.

Less fouling – better performance

A typical processing of water in industrial waste water applications tends to produce severe and strongly adhering fouling and scaling on metallic heat exchanger tubes, which very quickly reduce plant performance.

Polymer tubes of graphite do not show this behavior, and thus permit more efficient operation of industrial systems that use heat exchanging processes.

Heat transfer performance comparison



Test rig with artificial industrial wastewater (122 ppm Mg+, 300 ppm Si+, 9000 ppm Ca+) at 65 °C / 80 °C (149 °F / 176 °F) for 50 h

Our aim:

Full service for metal-free heat exchanger solutions.

Technoform has over 45 years of experience in extruding thermoplastics using countless combinations of different base materials and fillers. Based on this wide knowledge, we have first developed the polymer based, metal-free heat exchanger tubes.

But we soon realized that the market needs a more complete package, ranging from proper connection technology to end-plates, support plates or complete housings made of plastic, thereby providing a fully plastic evaporator or condenser stage in the end.

Our wide expertise in technical plastics and a strong commitment to individual solutions is the basis for fulfilling those very needs.

Connecting plastic tubes

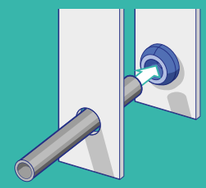
There are numerous ways of connecting a plastic tube to mounting plates in order to enable heat exchanger system functionality.

Finding the most reliable connection depends on various factors: is the mounting plate made from the same material as the tube?
What is the system pressure that has to be withstood? What chemicals are involved? What's the system's operating temperature? Is there a temperature gap that has to be compensated for concerning thermal expansion?
What is the distance between the tubes? The list is not exhaustive.

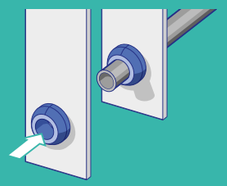
Talk to us for a customized solution based on your specific project parameters and requirements.

Rubber grommets – a fast and easy connection solution

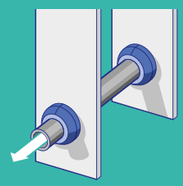
How to proceed:
1. Plug grommet into plate.



2. Push tube through rubber grommet.



3. Insert second grommet ...



4. ... and push further. Done!

Automotive

Aviation

Chemical Industry

Construction

Electrical Engineering

Insulating Glass

Lighting

Machine Construction

Oil & Gas

Power Generation

Railway

Seawater Desalination

Shipping

Ventilation/
Air Conditioning

Windows/
Doors/Facades

› Haven't found your industry? Ask us.

We love to innovate your industry.

Even when it’s not about corrosion.

Originally started with tailored plastic profile solutions, Technoform has always been opening up new business fields – and still does. Providing holistic know-how and technical expertise, we are a trusted partner and problem solver for various industries today, from construction and insulating glass to automotive and aviation, from oil and gas to wastewater treatment and seawater desalination.

Our promise: consistent high quality and fastest delivery times, from the initial idea to the first sample, from pilot lot to serial production. You’re looking for a plastics extrusion specialist? We make your task our own.

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