

PFAUDLER

GLASS-LINED
& ALLOY SYSTEMS

Pf

Technologies

PHARMA GLASS

PPG - RESISTANT,
SMOOTH, CLEAN

ION SENSITIVE

PH
VALUE
2.0

<1
1
2
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10
11+



GLASTEEL

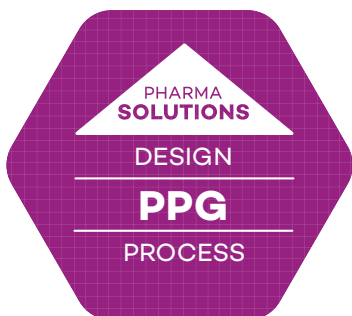
ANTI CORROSION
STICK
STATIC

Pfaudler
Defining the standard

Pf

Pfautler PharmaGlass

PPG – smoother, cleaner, more resistant



The process equipment of the chemical and pharmaceutical industries has been characterized by great similarity – especially in terms of glasslined reactors and components. However, the requirements on the production processes of these industries are quite different today. Two of these requirements of the pharmaceutical industry are increased purity in order to comply with the FDA and GMP requirements, and alternating alkali/acid operations.

The response: Pfautler PharmaGlass PPG

Pfautler's response to the demand for process-specific equipment and solutions tailored to the needs of manufacturing pharmaceutical products, vitamins and fine chemicals is the **Pfautler PharmaGlass PPG**.



Properties satisfying new needs

The result is a glass that is smoother, cleaner, and more resistant than all other types known so far. Its benefits meet exactly the requirements of FDA-validated production processes.

- Extremely smooth surface. Product incrustation is significantly reduced, or totally eliminated, lower cleaning efforts and times.
- Glass composition: no heavy metals can be dissolved, the products remain pure.

- Light-blue color – improved contrast to the usually white pharmaceutical products, good reflection of light, for easier optical process monitoring.
- Improved resistance to alkalis, therefore, suitable for neutralization of alkalis without the need to use stainless steel apparatus.
- Longer life with alternating operation (acid/alkali) or when cleaning with alkali detergent or CIP.

Extremely smooth surface

When **Pfautler PharmaGlass PPG** was developed, one primary challenge was the surface quality. The smoother the surface, the fewer incrustation is to be expected.



Pfautler PharmaGlass PPG has an extremely smooth surface. Thus, product incrustation is efficiently avoided, furthermore, the time required for cleaning is reduced significantly.

The benefits are obvious: shorter and fewer downtimes, the systems are more productive.

The extremely high surface quality is preserved even after prolonged service times. Corrosion tests have shown that its roughness after an acid or alkali attack is much lower than with commercially available glass types. The surface of Pfautler PPG is much smoother – even after a corrosive attack – than that of healthy, electropolished stainless steel surfaces.



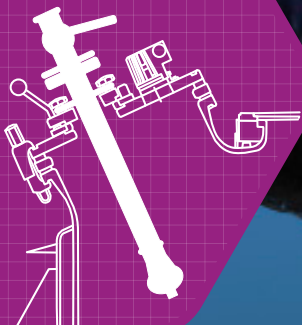


PHARMAGLASS **PPG** PROPERTIES

ADK α_{20-400}	10^{-7} [K ⁻¹]	97-100
Impact resistance		20-24 Nm
Dielectric strength		> 20 kV/mm
Specific electrical resistance*		> 10^{12} Ω cm
Adhesive strength		> 100 N/mm ²
Wear		< 6 mg cm ⁻² h ⁻²

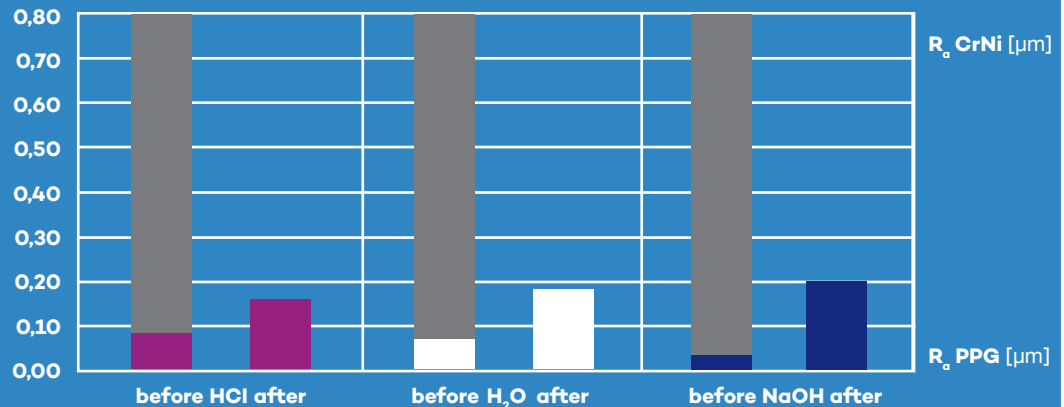
*at room temperature

**EXTREMELY
SMOOTH**



CHANGE IN ROUGHNESS OF PHARMAGLASS

During corrosion tests compared to electropolished stainless steel



Pfautler PharmaGlass

PPG – the solution for added performance

Higher product purity

Demanding pharmaceutical products require demanding production facilities in order to ensure top quality. Reactors lined with **Pfautler PharmaGlass PPG** contribute to purity, because Pfautler PharmaGlass is practically free from heavy metals – i.e., no heavy metals can be dissolved. The proportionate heavy metal content is below the analytical detection limit.

Cleaner apparatuses through improved optical monitoring

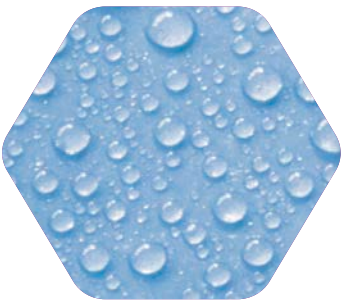
Pfautler PharmaGlass PPG has a light-blue color, thus increasing contrast with white or colored products. Furthermore, the light-blue color improves the lighting of the reactor inside. Improved monitoring of the production process and safe verification of the cleaning result are now possible.

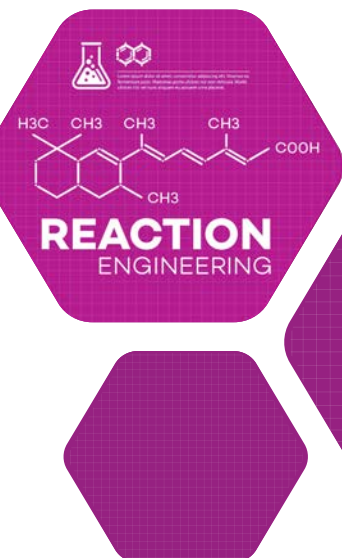
Higher resistance to aggressive substances

One of the properties characteristic of glass is its resistance to aggressive substances, even at high temperatures. Compared to other materials, glass is extremely resistant to acid media. The **Pfautler PharmaGlass PPG** for the first time combined this property with a significantly improved resistance to alkali substances.

Greater application range

These benefits are convincing: apparatuses lined with **Pfautler PharmaGlass PPG** even withstand varying loads, thus offering a greater application range. Changing between stainless steel and glassed apparatuses is practically no longer necessary. You will save real money in terms of investment and in your day-to-day operations.





RATE OF CORROSION

Rate of corrosion	0.1 mm/a	0.2 mm/a
in pH -1	125 °C	ca. 144 °C
in pH 7	160 °C	ca. 170 °C
from pH 13	75 °C	ca. 88 °C

*Analytical detection limits according to applicable DIN standards

The analysis was carried out on glass grains sized.

0.3 < 0.425 mm DIN 719

0.3 < 0.500 mm DIN 720

EXTRACTION TEST PPG

	DIN ISO 719* at 98°C [ppm]	DIN ISO 720* at 121°C [ppm]
Sb	< 0.01	< 0.01
As	< 0.02	< 0.02
Ba	< 0.001	< 0.001
Pb	< 0.01	< 0.01
Cd	< 0.002	< 0.002
Cr	< 0.01	< 0.01
Co	< 0.001	0.001
Fe	0.02	0.02
Cu	< 0.01	0.09
Mn	< 0.005	< 0.005
Mo	< 0.01	< 0.01
Ni	< 0.005	< 0.005
Nb	< 0.1	< 0.1
Sr	< 0.001	0.003
Ta	< 0.1	< 0.1
V	< 0.005	< 0.005
W	< 0.1	< 0.1
Zn	< 0.01	< 0.01
Sn	< 0.05	< 0.05

CORROSION CURVE OF PFAUDLER PHARMAGLASS PPG

max. 0.1 mm/a

max 0.2 mm/a

