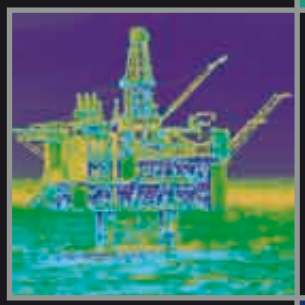
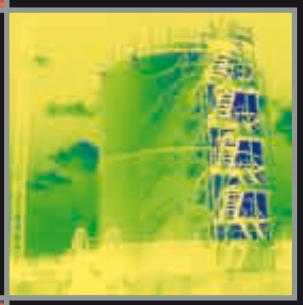
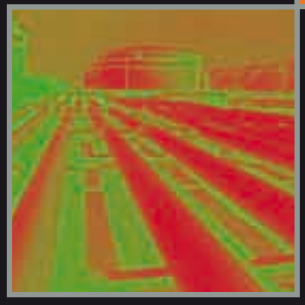
CERAMIC POLYMER

ULTRA • PERFORM • COAT







INNOVATIVE • COATINGS

The real corrosion protection – permanent, resistant, solvent-free!

Index

The Ceramic Polymer Concept

The Ceramic Polymer GmbH produces high-performance coatings with integrated micro ceramic particles for different fields of application. The properties of the ceramic – chemical resistance, abrasion resistance and weathering stability – justify the high quality of our coating systems. By extra integration of microscopic special particles, we generate coating products which provide the highest protection properties.

We feature innovative coating solutions – consistent effort towards new and further developments of our products is a major part of our company philosophy. Certificates and results of extensive test series of independent research institutes prove the superiority and quality of the Ceramic Polymer's coating systems.

Direct on steel / direct on concrete – high performance without primer

The Ceramic Polymer coatings are applied directly onto the blasted substrate without the previous use of a primer. In this way extreme adhesion is achieved. That signifies essential advantages in comparison to conventional multi-layer systems.

Product Advantages

- highest corrosion protection
- outstanding adhesion
- extreme abrasion resistance
- excellent resistance to impact
- high bending flexibility
- 100 % solvent-free
- excellent chemical and thermal resistance
- direct application on steel, stainless steel, concrete
- high savings on application costs
- easiest use
- easiest repair
- extreme durability

Scopes of Application

- tanks for crude oil, hydrocarbons, chemicals
- vessels for drinking water & food
- special tanks for urea (Ad-Blue), bio oils
- biogas fermenters
- digestion towers
- production vessels of all kinds
- waste water ponds
- bridges and steel constructions
- tubes and pipelines
- swimming pool filters
- maritime constructions e. g.
  - – ships and offshore platforms
  - – tanks and vessels on ships and offshore
  - – sheet piles and harbour facilities
  - – on- and offshore facilities and structures
  - – jetties and singlebuoy mooring systems

Tanks & Pipelines

You place high requirements – We provide ultimate solutions

Due to the outstanding physical properties, the Ceramic Polymer coating systems provide a versatile range of use for ***tanks*** and ***pipelines.*** Our products feature ultimate corrosion protection against natural influences and long-term UV-stability for external coating of tanks and steel ***constructions***. As internal coatings for ***special tanks*** and ***process vessels***, they perform high-grade resistance properties at elevated operating temperatures.

Our high-performance coatings achieve the complex requirements in the range of ***oil and gas*** to their full extent. The demands for adequate corrosion protection in this field of application require excellent chemical resistance at high operating temperatures combined with extreme pressure resistance.

One of our premium products was tested extensively by the research institutes of Saudi Aramco, the biggest oil company worldwide. Our coating is approved for ***Saudi Aramco-Standards APCS-2i, APCS-28*** and ***APCS-117***. Various internal coating applications for newly built and renewed tanks in Saudi Aramco oil and gas refineries are primarily conducted with our approved product.

Particular parts of our product range are ***coating systems with electrostatic dissipation capabilities*** which we designed for the storage of highly flammable substances. When oxygen is present during electrostatic charging, explosive reactions could occur in the vapor phase, the upper area of the tank. By the addition of nano-carbon fibers, conductive chains are formed in the coating. These facilitate the dissipation of electric charging and prevent dangerous explosive reactions of the storage fluids.

By integration of special particles into the ceramic-filled epoxy resin coatings, ***isolating properties*** are attained. These specific coating systems are especially qualified outstandingly for tanks and pipelines with exceeding temperature loads. Furthermore, they can effectuate the reduction of nuclear radiation (gamma rays) substantially.

Through several years of intensive research, we have developed ***special internal coating systems for storage tanks of crude oil and all kinds of hydrocarbons***, which provide a steady ***long-term protection against biocorrosion induced by SRB bacteria***.

These coating products prevent fatal pitting corrosion effectively. The unique mode of operation has been registered for international patent. For more information, please refer to the topic "Biocorrosion".

1) Crude oil storage tanks, internal coating

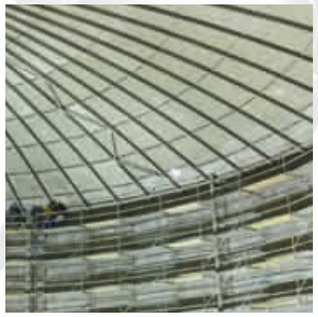
2) Refinery process vessel, internal coating

Tests & Certificates of independent institutes

- Saudi Aramco Approvals APCS-2i, APCS-28 and APCS-117
- 10.000 hours salt spray test
- thermo-shock-test (from 180°C to zero, 1.000 cycles)
- resistance to acids, alkaline solutions, (pH 4-11), brine, oils, CO_2, H_2S, Hg, HgS at operating temperatures up to 110°C
- resistance to E85 – ethyl alcohol, methanol/petrol, add-blue-solutions, RME
- resistance against methyl alcohol
- long-term resistance against deionate (fully demineralized water) at 50°C
- >9.000 hours stability against "killer solution" – 98% H_2SO_4 / pure methyl alcohol / 3% NaCl-solution (1/3, 1/3, 1/3 at 50°C)
- cathodic disbondment test at 1,5 V (30 + 60 + 90 days at 60°C)
- autoclave test with explosive decompression (natural gas, 100 bar, 100°C)
- electrostatic dissipation capability < 10^6 Ω surface resistance

1) Condensate-stripper, gas refinery, internal coating

2) Storage tanks for transformer-oil, internal and external coating



3) Storage tank for diverse hydrocarbons, internal coating

3) Pipeline, internal coating
4) Underground fuel tanks, internal coating

5) Degassing tank, internal coating

Biocorrosion

Unique coating system against anaerobe biocorrosion induced by SRB bacteria!

According to Patent-No. WO 2011/000339 A2

When considering the definition of "corrosion", you first think of aerobe corrosion where metal is distroyed under the influence of oxygen and water. However, a major part of all corrosion damages occur under full exclusion of oxygen, for instance in the bottom area of filled storage tanks or in pipeline systems.

Mainly responsible for the anaerobe corrosion are sulfate reducing bacteria (SRB). These microorganisms accelerate corrosion of steel in crude oil tanks and other technical installations, which come in contact with water and organic materials. Such surfaces have to be cleaned continuously; otherwise, gel-like biofilms form due to the rapid propagation of SRB bacteria. This process causes biofouling with a strong smell and slime formation which could be a precursor of biocorrosion. Evidentially anaerobe biocorrosion causes a 10-times higher oxidation rate in comparison to atmospheric corrosion.

Through several years of intensive research in corporation with an independent institute, Ceramic Polymer GmbH has developed high resistant internal coatings for biogas plants and storage tanks for crude oil and all kinds of hydrocarbons. The unique functionality of these coating systems provides a long-term protection against SRB-induced biocorrosion. Special biocide crystals are chemically integrated into the polymer matrix. By the tight encapsulation of the biocide the coating material is physiologically harmless during application procedure and also after curing.

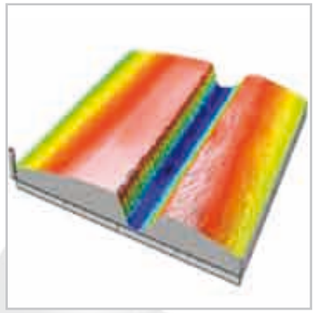
The SRB settle down primarily as tubercle-shaped colonies in niches with less circulation. They find optimum conditions in lower areas of filled oil tanks, for instance in cracks and pores of the coating.

Sulfate reducing bacteria (SRB) produce for the preservation of their O_2-independent metabolism toxic hydrogen sulfide (H_2S). The biocorrosion is caused by the enzyme hydrogenase, which is excreted by the SRB. This enzyme dismantles the protecting hydrogen film on the steel surface of the tank. Simultaneously, several redox reactions occur. Thus iron(II)sulfide is generated, which builds a black crust around the rust tubercles. By further physical-chemical reactions even high quality steel is destroyed.

Fatal and rapidly advancing pitting corrosion is the result. Even concrete substrates are extremely damaged by the SRB-produced hydrogen sulfide, which cause heavy concrete erosions.

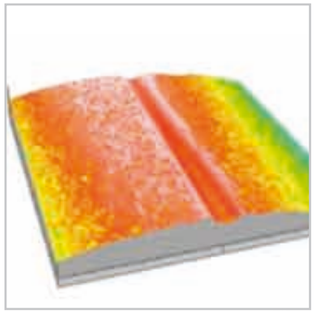
The novel anti-SRB internal coatings of Ceramic Polymer GmbH prevent anaerobe biocorrosion from the beginning. The first population of SRB and the consequential building of rust tubercles in emerged micro cracks are provably avoided. The depot effect of the biocide crystals causes a long-lasting crack protection against SRB settlement.

For detailed explanations regarding the mechanism of anaerobe biocorrosion, please refer to our topic „Research and Development".



*1) **Coating without biocide***
After a month-long test the coating was removed. The profilometric test photo shows heavy attack of the SRB. The steel reveals deep corrosion cavities.

*3) **Coating without biocide***
After a month-long test the pickled test rod shows deep biocorrosion. (depth of corrosion cavity 150-200 µm)



*2) **Coating with integrated biocide***
After a month-long test the coating was removed. The profilometric test photo of the steel shows much less corrosion depth.

*4) **Coating with integrated biocide***
After a month-long test the pickled test rod shows much less corrosion depth. (depth of corrosion cavity 50-80 µm)

1) Pitting corrosion, induced by anaerobe biocorrosion

2) Advanced anaerobe corrosion in bottom area of oil tank

3) Extreme concrete erosions by chemical attack of SRB-produced hydrogen sulfide

Specific biocides in nano-crystalline shape

are integrated by a patent pending method in a ceramic-filled polymer matrix.

Special functionality

Due to temperature gradients or mechanical impact, cracks in the range of nano- or micrometers occur in every coating during operation time. The SRB bacteria settle down primarily in those cracks, which appear as protective niches with low circulation. As soon as micro cracks occur in the coating, the special biocide crystals burst and unfold their effect within the whole crack. The SRB are killed before they can settle. The existing depot effect causes a long-lasting biocidal corrosion protection without localized erosion.

No negative impacts occur to the necessary bacterial processes in the biogas fermenter, because the biocidal effects are restricted locally to the micro cracks in the coating.

Safe application

During the application procedure and also after the curing, the biocidal active component remains at first tightly encapsulated in the polymer matrix, so that the coated surface is not antiseptically active and therefore physiologically harmless. The kind of biocide employed is virtually harmless for humans. The application of these effective coating systems can easily be conducted by airless spraying method or roll and rake.

Constant durability

Extensive test series by our independent research partner have proven clearly that biocorrosion induced by SRB bacteria can be largely prevented by using our special coating products. Therefore, effective and targeted protection of concrete and steel substrates for biogas plants and tanks for crude oil and hydrocarbons is permanently achieved.

4) Refinery process vessel, internal coating against SRB bacteria

5) Biogas fermenter, internal coating on concrete against SRB bacteria

6) Crude oil separators, internal coating against SRB bacteria

Biogas

Highest efficiency for new building and renewal of biogas plants

Even after a short operating time, extreme damage to concrete and steel can occur due to the extensive chemical attack of the highly corrosive ***biomass*** and ***biogas***. Furthermore, the use of herbal and animal waste material such as pomace, slaughterhouse waste, slop, fat and oil increases the corrosiveness of the substance.

Conventional coating systems for biogas plants provide inadequate corrosion protection. Solvent-based coating products cause, for instance, osmotic blistering and the so-called "washed out concrete" is induced by insufficient acid resistance. Concrete erosions of 1 to 2 cm and extreme corrosion damages on all steel components are measured per year.

Our specific and targeted coating products feature durable value preservation for ***fermenters, hygienisation tanks*** and ***all kinds of component parts*** of biogas plants. These systems are applied directly onto steel and even concrete substrates without the previous use of a primer.

Through several years of intensive research in corporation with an independent institute, we have developed ***special internal coating systems for biogas plants***, which provide a ***steady long-term protection against biocorrosion induced by SRB-bacteria***. The unique mode of operation has been registered for international patent. For more information, please refer to the topic “Biocorrosion”.

Picture: Metallbau Blechinger, Germany

Pictures: MT-Energie, Germany

Picture: SLP Beschichtungs GmbH, Germany

Applications at winterly temperatures down to minus 10°C

The combination of specific fillers and reactive hardener compositions enables the use of our winter product series during ***dry winter seasons*** with ambient ***temperatures down to -10°C***. These special coating systems are still sprayable even under these conditions and they cure within 2-3 days completely. After 7 days of curing, the coated surface is generally chemical resistant, thus largely preventing temperature-dependent down times.

Even with this special feature, the physical properties of our high-performance products remain intact. Besides excellent chemical resistance against highly corrosive liquids and gases at elevated temperatures, our solvent-free “winter systems” provide an outstanding adhesion on steel and concrete substrates. Due to their direct application without use of a primer, new buildings and renewals of biogas plants can be conducted efficiently during the winter season. An absolutely innovative product line on the international market!

Pictures: MT-Energie, Germany

Picture: Energie-Anlagen Röring, Germany

Drinking Water & Foodstuff

Safe coating systems feature essential certitude

We invest constantly in specific test series to provide high quality, solvent-free coatings and guarantee the safety ***for drinking water*** and ***food applications***. The necessary criteria of the German Federal Health Office are fulfilled in different groups. Thus, our products are usable in scope of ***drinking water (German standard KTW)***. They show for instance hardly verifiable chlorine absorption or release of substances, which would promote microbiological growth and impair the drinking water.

In other, month-long test series according to ***DVGW-W270***, no abnormally microbial slime formation occurred on the coated surface. Hence, our certified products are applicable as internal coating for drinking water tanks and pipework, also in microbiological regards.

Our coating systems display safety for drinking water even at high ***operating temperatures up to 85°C***, which is attested by extensive analysis of an independent institute.

1) Water tower "Aquaglobe", internal coating

2) Sand filter vessels for drinking water, internal and external coating
3) Swimming pool filters, internal coating

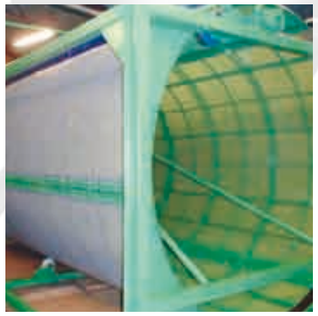
For ***foodstuffs*** of neutral, acidic and alcoholic kind, our coating systems are continuously tested and approved in accordance with physical-chemical and microbiological assessments. None impermissible emissions of substances from the coating; smell, taste and quality of the storage fluids (hydrous, light and concentrated alcohol as well as acidic liquids) are not affected.

The coating for different kinds of pools has to meet the guidelines for ***swimming and bathing pool water (German standard KSW)***. Our product systems are tested on migration behavior to chlorine for cold and warm pool water as well as very warm whirl pool water up to 40°C. Hardly verifiable chlorine absorption or release of oxidable substances occurred. Therefore, the consistency of the swimming pool water is not impaired.

Due to the low viscosity and the fast curing times, our coating material is preferentially used for the restoration of corroded ***pipework systems***. The application according to the patented Promotec-system is achieved by a pressure assisted vacuum process.

4) Sand filter vessels for drinking water, internal and external coating

5) Drinking water tank, internal and external coating



6) Fish farm filter, external coating

1) Filters for drinking water, internal and external coating

2) Restoration of pipework by the Promotec-system; corroded, cleaned and coated pipes

Tests & Certificates of independent institutes

- German standard (KTW) - drinking water approval
- DVGW-W270, growth of microorganisms (biofilm)
- German standards - foodstuff approval, microbiological and physical-chemical analyses
- German standard (KSW) - swimming water approval (open air, indoor, warm whirl-pool)
- Drinking water installations on- and offshore - Folkehelse, Norwegian Institute of Public Health, Oslo

3) Anaconda basin at a German zoo

4) Fish pond for exotic fishes

5) Coated swimming pool

Maritime Techniques

Extensive product range for maritime individuality

Coatings, which are being used for ***offshore applications*** have to meet the highest demands. The constantly moist and salt-laden air combined with intensive UV radiation is highly corrosive. Our unconditionally seawater-resistant coating systems enduringly prevent all types of maritime facilities from corrosion and abrasion.

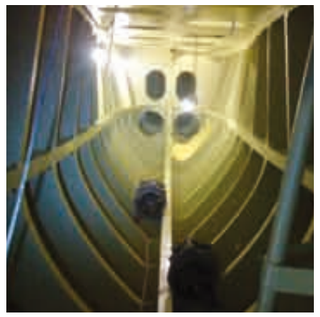
Within the ***intertidal zone*** and ***splash zone***, the oxygen content of the sea water is increased due to currents and waves. Hence, the corrosion process is enormously accelerated by constantly moving water. In addition, severe mechanical abrasion results from flowing water. For this field of application we provide ideal protection.

For new buildings and renewals of ***ship bodies***, high impact resistance is required. The sheer rails on the sides are exposed to heavy loads during landing processes. Rudder blades show oftentimes deep cavitation erosions. ***Deck coatings*** have to be weather-proof, skid-proof and usually chemical resistant. The Ceramic Polymer coating products fulfill these requirements and provide long-lasting impact and abrasion resistance.

Furthermore, our coatings are excellently applicable as internal coatings for different kinds of tanks on the ships. Our portfolio contains ideal protective systems for ***waste water tanks*** and ***freshwater tanks*** as well as ***pool water tanks*** and ***ballast water tanks***. Thus we make a considerable contribution to effective value preservation within the whole range of maritime techniques.

1) Crude oil tanks and separators on offshore platform, internal and external coating
2) Lock gate, external coating

3) Steel construction of singlebuoy mooring system, external coating



4) Ballast water tank, internal coating

5) Sheet piles of man-made island, external coating

6) Rudder, rear and sheer rails, external coating
Picture: Scandlines, Germany

1) Segment of offshore wind energy plant, external coating
2) Lock gate, external coating

3) Sheer rails on ship body, external coating
Picture: Scandlines, Germany

Tests & Certificates of independent institutes

- ISO 20340 – Performance requirements for protective paint systems for offshore and related structures
- Germanischer Lloyd approval for ballast water tanks
- 10.000 hours salt spray test
- cathodic disbondment test at 1,5 V (30 + 60 + 90 days at 60°C)
- autoclave test with explosive decompression (natural gas, 100 bar, 100°C)
- German standards (KTW) - drinking water approval
- DVGW-W270, growth of microorganisms (biofilm)
- German standards - foodstuff approval, microbiological and physical-chemical analyses
- German standards (KSW) - swimming water approval (open air, indoor, warm whirl-pool)
- Drinking water installations on- and offshore - Folkehelse, Norwegian Institute of Public Health, Oslo

4) Harbour structure, external coating

5) Crude oil tanks and separators on offshore platform, internal and external coating

6) Single buoy mooring system, external coating

Chemicals

Our highest performance coatings - outstanding chemical resistance

We at Ceramic Polymer GmbH are constantly working on new and further developments of our high quality coating products in order to provide an extended and versatile product range. Recently, in cooperation with an independent research institute, we generated novel protective systems which feature high-grade resistance against aggressive chemicals at elevated operating temperatures.

Our innovative, solvent-free 2-component coatings with silanized high-tech micro and nano particle filling are based on the newest multifunctional and hybrid epoxy novolac resins. These coating systems are specifically devised for extremely aggressive environments.

By the combination of selected, highly functional fillers and different resin systems, we achieve the outstanding chemical resistance. We use organo-ceramic nonmetallic ingredients. These porous fillers enable the tight anchoring of the resin, soaking into all porosities of the particles, thus enhancing the inner texture. The employed pure organic fillers are optimally compatible with the organic resins. PTFE-additives increase the resistance properties and facilitate the tight cross linking of the polymer chains. Furthermore, we utilize specific amino acid polymer molecules, which show an affine behavior towards metal. They adhere strongly to any metal, inducing a perfect adhesion by dissolving residual oxides!

1) Storage tanks for various acids, internal coating

2) Tanks for process water, internal coating
3) Storage tanks for hot glycols, internal coating

For the maximum protection – our premium performance coatings for stainless steel substrates

In furthering our product developments, we have generated premium coatings for stainless steel substrates. The most remarkable properties of these coatings are their superior chemical resistance and phenomenal adhesion strength. These innovative coating systems are intended for special applications with highest requirements in which stainless steel is insufficient on its own. Hence, Ceramic Polymer GmbH provides coatings with considerable capabilities which differentiate themselves clearly from other available products on the market.

1) Exit flues of chemical plant, internal coating

2) Storage tanks of hot fatty acids, internal coating

3) Tanks for aggressive bio fuels, internal and external coating

The new Ceramic Polymer coating products provide outstanding properties:

- extreme adhesion > 30 N/mm²
- excellent chemical resistance against hot acids and alkaline solutions
- excellent chemical resistance against hot corrosive gases
- simple and solvent-free application by airless spraying methods
- direct application without previous use of a primer

We draw the line for chemicals – Secondary Containment

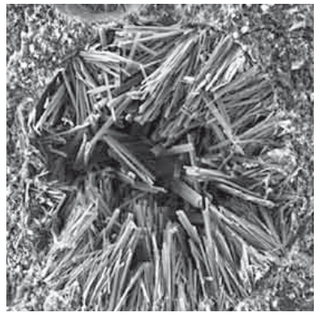
For aggressive chemicals a safe secondary barrier is essential. Tanks and basins with hazardous substances, no matter if they are outdoors or within a storage building, need a chemical resistant leakage protection. Different substrates such as steel and concrete can be complemented with our systems to provide ultimate environmental protection. Our coating products improve even high quality drip pans of stainless steel to get a durably effective protection against chemicals.

4) Bottom of double-walled tank for chemical residue mix, internal coating
5) Secondary containment field for storage tanks of phosphoric acids, external coating

6) Double-walled tanks for ethanol, internal coating and concrete tank pit, external coating

Concrete Protection

Simple and direct – perfect functionality with a strong hold



1) Expansion effects

2) Concrete erosions

3) Corrosion of steel reinforcement

Concrete substrates also need a resistant coating for a trouble-free operation. The belief that concrete could permanently withstand aggressive chemical attacks or heavy weather conditions without protection is a false conclusion. As a matter of fact, air pollution and resulting acid rain induces by contained sulfur dioxide the corrosion of concrete. By enduring contact with chemicals or aggressive substances, concrete is destroyed in different ways. The sulfate attack causes expansion effects. The sulfuric acid attack effectuates extreme concrete erosions. Also anaerobe microorganisms (sulfate reducing bacteria - SRB) provoke fatal concrete erosions by the excretion of hydrogen sulfide. Fluids and gases, which ingress into the porosities of the concrete, can cause corrosion on steel reinforcements.

The Ceramic Polymer protective coatings provide excellent resistance against various chemicals and gases, steady acid resistance, high abrasion resistance and drinking water approvals for versatile use relating to concrete protection. For more information regarding SRB-induced biocorrosion and our new long-term protection system, please refer to the topic “Biocorrosion”.

Our coatings are applied directly onto clean and blasted concrete without previous use of a primer. Due to the low viscosity of the coating products, all porosities are easily filled in and an outstanding adhesion is thereby achieved. The application is conducted by airless spraying method or simply by roll and rake.

Versatile scopes of Ceramic Polymer concrete protection coatings

- waste water systems
- septic tanks
- sewage plants
- drip pans
- pipework
- cisterns
- rain retention basins
- oil and petrol separators
- biogas plants
- secondary containment applications

4) Percolation tank - Picture: Finger-Beton, Germany
5) Sewage pipe system – Picture: Gerocret, Austria

6) Waste water separation vessel

Secondary Containment – protecting nature and environment

1) Drip pan for hydraulic fluids

2) Drain pan for storage tanks of chemicals

3) Drain pan for production of chemicals

Ceramic Polymer GmbH sets another focus on the protection of nature and the environment. Our solvent-free coating systems are employed for secondary containment applications at filling and reloading points of different industrial fields. In the handling of chemicals and other substances, which are hazardous to water, an adequate prevention of environmental contamination is mandatory.

Ceramic Polymer GmbH provides for this kind of “indirect corrosion protection” high-grade resistant coatings which can be easily applied.

We deliver high quality concrete coatings for

- drain trays for road and railway vehicles
- drip pans for chemical drums
- drain trays for petrol stations
- containment areas for bulk tanks
- tank pits for chemical reservoirs
- containment vessels for production facilities

4) Drip pan for printing ink
5) Concrete protection in production of phosphoric acid esters

6) Large tank pit for sulfuric acid fabrication

Flooring Systems

Ceramic Polymer flooring systems – safe, resilient, comfortable

1) Production hall of pharmaceutical industry, chemical resistant floor coating

2) Production hall, antistatic flooring system

3) Parking deck, high UV-stability and abrasion resistance

The requirements to functional floor coating systems for different industrial, medical and laboratory conditions are very high. The flooring systems of Ceramic Polymer GmbH provide outstanding physical properties by integrating ceramic- and other special particles in the polymer matrix of the liquid coating products.

The demands for industrial floors are placed on ***extreme load capacity, skid-proof surface*** or ***highly thermal and chemical resistance***. Our products satisfy or exceed these standards in its entirety.

The versatile Ceramic Polymer coating systems are applicable for almost all substrates. Concrete, screed, cement and steel can be coated and sealed sound-absorbent, planar, efficient and physiologically harmless. Due to the seamless surface, our flooring systems are easy to clean and therefore meet the highest hygienic demands.

Our floor coatings facilitate easy use with conventional application tools, such as rakes or rollers. Ceramic Polymer special primers provide a non-porous substrate. Our solvent-free, unplasticized coatings on epoxy- or polyurethane-basis feature by versatile physical properties the perfect floor protection.

The self-leveling and self-ventilating sealing fulfills beside specific product requirements also decorative demands. Fast curing times guarantee short down times and thereby smooth production processes.

4) Storage depot, extreme abrasion resistance floor
5) Production hall, antistatic flooring system

6) Storage depot, antibacterial flooring system

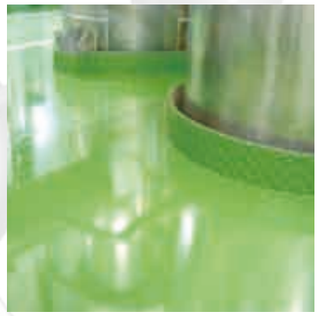
Significant effects for high demands

- In the range of ***production*** and ***logistics***, our floor coating systems are applicable for extreme heavy loads by optional fibre reinforcements. Machinery and high bay racking with a heavily concentrated load stand with our products on solid ground.

- Our flooring systems are resistant against chemical substances such as acids, alkaline solutions, grease or oils. Thus they are qualified for ***electroplating*** and ***chemical industry***.

- Furthermore, our product portfolio contains elastic, ergonomic and skid resistant floor coating products, which are easy to clean sanitarily; the perfect choice for all kinds of ***hospital floors*** and ***decontaminable laboratory floors***.

- A variety of coating systems is required for ***parking decks*** and ***underground garages***. Among long-term heavy-duty floor protection we provide impact resistant and durable wall coatings as well as adequate marking products for lanes and walkways.



1) Heavy-duty floor with fibre-reinforcement
2) Floor of storage depot, physiologically harmless

3) Parking garage, skid-proof and abrasion resistant floor coating
4) Assembly hall, antistatic flooring system

5) Mounting surface under heavy-duty crane with fibre-reinforcement
6) Brewery floor, physiologically harmless

- For the ***food*** and ***pharmaceutical industry***, particular hygienic standards are required. Beside extreme chemical resistance e.g. to disinfectants, the floor has to be easy to clean sanitarily and acutely skid resistant. Another need is physiological harmlessness of the coating surface, which our products fulfill constantly.

- Due to the outstanding thermal resistance, our floor coating systems satisfy highest standards. They provide low temperature stability of -50°C for ***refrigerated warehouse*** and down to -150°C for ***cryogenic technology***. Our products offer stability up to +150°C for ***hot chambers*** without reduction of any physical properties. The flexibility and tensile strength all remain also at extreme hot or cold temperatures.

- Specific properties are required for the sealing of ***clean-rooms***. For the fabrication of diverse products in electronic industry, food and pharmacy as well as the field of cosmetics are clean-room conditions with limited contamination necessary. Our special coating systems fulfill all demands for floor, wall and ceiling of clean-rooms such as minimum emissions of VOC/AMC and particles, mechanical and chemical resistance.

- By addition of nano-carbon-fibers and special conductive polymers, ***electrostatic dissipation capability*** is achieved, which is most relevant for the production of electronic components, e.g. microchips and modules. Our particular flooring systems facilitate the controlled and constant dissipation of electrostatic charging.

Ceramic Polymer Application-Tool



In 3 steps we guide you to the right coating product






1. ➡ Application-Matrix (AMT)

First you decide via AMT, which requirements are important for you, thus making a preselection of suitable coating products.

2. ➡ Product-Matrix (PMT)

You can see in the PMT in detail which specific properties the products you have selected provide. Now you can evaluate the right coating for your demands.

3. ➡ Certificate-Matrix (CMT)

What kind of tests have the preselected coatings passed?
In the CMT you get an overview of the certified performances of our coating systems.



We wish to point out the fact that a specific consultation by Ceramic Polymer GmbH is absolutely necessary. Our Matrix Tables with different internal coatings for tanks and several flooring systems shall simplify the preselection of coating products and facilitate an effective consultation. But only the qualified product consultants of Ceramic Polymer GmbH can clearly estimate which coating material is the optimal choice by careful consideration of all application parameters.

Application-Matrix (AMT)

		Steel	Stainless Steel	Concrete	Pressure	Temperature	Chemicals	Abrasion	Biocorrosion (SRB)	Drinking Water & Foodstuff	Sea Water	Biomass	Nuclear Radiation
Coatings	Proguard CN 100 iso	✓		✓ *	✓	✓	✓	✓			✓		✓
	Proguard CN 200	✓		✓ *	✓	✓	✓	✓		✓	✓	✓	
	Proguard CN 200-SRB	✓		✓ *	✓	✓	✓	✓	✓		✓	✓	
	Proguard CN-1M	✓		✓	✓	✓	✓	✓			✓	✓	
	Proguard CN-1M-SRB	✓		✓	✓	✓	✓	✓	✓		✓	✓	
	Proguard CN-OC		✓		✓	✓	✓	✓			✓	✓	
	Ceramic-Polymer SF/LF	✓		✓ *	✓			✓		✓	✓		
	Ceramic-Polymer SF/LF-SRB	✓		✓ *	✓			✓	✓		✓	✓	
	Ceramic-Polymer SF/LF-ARAMCO-APCS-2i, 28, 117	✓		✓ *	✓	✓	✓	✓			✓	✓	
	Ceramic-Polymer SF/LF-SRB-ARAMCO-APCS-2i, 28, 117	✓		✓ *	✓	✓	✓	✓	✓		✓	✓	
	Ceramic-Polymer 232	✓		✓	✓			✓			✓		
	Ceramic-Polymer 9531	✓		✓	✓			✓			✓		
Floorings	Flooring System „standard“			✓	✓			✓		✓			
	Flooring System „antistatic“			✓	✓			✓					
	Flooring System „chemical resistant“			✓	✓		✓	✓					

➤ *The above listed product properties could differentiate from actual achievements through specific application parameters. Please get in contact with technical services of Ceramic Polymer GmbH to select the optimum coating product for your scope of application.*

* *The need of a suitable primer has to be estimated by Ceramic Polymer GmbH.*

Product-Matrix (PMT)

	Product Performances	Proguard CN 100 iso	Proguard CN 200	Proguard CN-1M	Proguard CN-OC (for stainless steel)	Ceramic-Polymer SF/LF	Ceramic-Polymer SF/LF-ARAMCO-APCS-2i, 28, 117	Ceramic-Polymer 232	Ceramic-Polymer 9531
Physical Properties	temperature resistance	wet 140°C / dry 170°C	wet 130°C / dry 150°C	wet 130°C / dry 150°C	wet 130°C / dry 150°C	wet 80°C / dry 90°C	wet 150°C / dry 160°C	wet 80°C / dry 90°C	wet 60°C / dry 120°C
	100 % solvent-free – 100% volume solids	✓	✓	✓	✓	✓	✓	✓	✓
	excellent adhesion	✓	✓	✓	✓ (on stainless steel)	✓	✓	✓	✓
	high abrasion resistance	✓	✓	✓	✓	✓	✓	✓	✓
	resistant against fast and large temperature changes	✓	✓	✓	✓	✓	✓	✓	✓
	optional: functionality against SRB-induced biocorrosion (long-term protection against pitting corrosion) Patent-No. WO 2011/000339 A2		Proguard CN 200-SRB	Proguard CN-1M-SRB		Ceramic-Polymer SF/LF-SRB	Ceramic-Polymer SF/LF-SRB-ARAMCO-APCS-2i ,28 ,117		
	optional: antistatic properties		✓	✓		✓	✓		
	drinking water qualification – German standard		✓			✓			
	food grade – German standard		✓			✓			
	swimming pool components – German standard (open air, indoor, warm whirl-pool)					✓			
	salt spray test	✓	✓	✓	✓	✓	✓	✓	✓
	autoclave test with explosive decompression (natural gas, 100 bar, 100°C)		✓				✓		
	resistant against cathodic disbondment	✓	✓	✓	✓	✓	✓	✓	✓
	sea water resistance	✓	✓	✓	✓	✓	✓	✓	✓
	refurbishment of ballast water tanks – Germanischer Lloyd					✓			
Chemical Resistances	acids, alkaline solutions, (pH 5-11), brines, oils, CO_2, H_2S, Hg ≤60°C	✓	✓	✓	✓	✓	✓	✓	✓
	acids, alkaline solutions, (pH >4), brines, oils, CO_2, H_2S, Hg ≤80°C	✓	✓	✓	✓		✓		
	acids, alkaline solutions, (pH >4), brines, oils, CO_2, H_2S, Hg ≤ 110°C	✓	✓	✓	✓		✓		
	acids, alkaline solutions, (pH <4), brines, oils, CO_2, H_2S, Hg ≤ 80°C	✓	✓	✓	✓		✓		
	E 85 – ethyl alcohol, methyl alcohol/petrol, add-blue-solutions, RME	✓	✓	✓	✓		✓		
	E 32 – cutting fluid	✓	✓	✓	✓	✓	✓	✓	✓
	100% methyl alcohol	✓	✓	✓	✓		✓		
	deionate, fully demineralized water	✓	✓	✓	✓		✓		
	H_2SO_4 solutions and saturated NaOH solution at 50°C	✓	✓	✓	✓		✓		
	¨Killer solution¨ - 98% H_2SO_4 / pure methyl alcohol / 3 % NaCl-solution (1/3+1/3+1/3 at 50°C)			✓	✓				

➤ *The above listed product properties could differentiate from actual achievements through specific application parameters. Please get in contact with technical services of Ceramic Polymer GmbH to select the optimum coating product for your scope of application.*

Certifikate-Matrix (CMT)

Tests and Analyses	Test Methods and Examinations	Standard	Proguard CN 100 iso	Proguard CN 200	Proguard CN-1M	Proguard CN-OC (for stainless steel)	Ceramic-Polymer SF/LF	Ceramic-Polymer SF/LF-ARAMCO-APCS-2i, 28, 117	Ceramic-Polymer 232	Ceramic-Polymer 9531
Temperature resistance	liquid and gaseous/dry storage substances	individual test	wet 140°C / dry 170°C	wet 130°C / dry 150°C	wet 130°C / dry 150°C	wet 130°C / dry 150°C	wet 80°C / dry 90°C	wet 150°C / dry 160°C	wet 80°C / dry 90°C	wet 60°C / dry 120°C
Adhesion on steel	pull-off test	ISO 4624	≥ 25 N/mm²	≥ 27 N/mm²	≥ 30 N/mm²	≥ 28 N/mm² (on stainless steel)	≥ 30 N/mm²	≥ 27 N/mm²	≥ 30 N/mm²	≥ 17 N/mm²
Abrasion resistance	taber abraser test – abrasion through friction rollers CS17 , weight : 1.000 g – 1.000 cycles	ASTM D4060	≤ 70 mg	≤ 70 mg	≤ 50 mg	≤ 50 mg	≤ 60 mg	≤ 70 mg	≤ 20 mg	≤ 70 mg
Functionality against SRB-induced biocorrosion	largely prevention of SRB-settlement and resulting pitting corrosion due to specific integrated biocide crystals	Patent-Nr. WO 2011/000339 A2		Proguard CN 200-SRB	Proguard CN-1M-SRB		Ceramic-Polymer SF/LF-SRB	Ceramic-Polymer SF/LF-SRB-ARAMCO-APCS-2i, 28, 117		
Drinking water qualification ≤ 20°C	chlorine absorption and release of substances from the coating	KTW – German Standard					✓			
Drinking water qualification ≤ 85°C	migration of substances from the coating into the heated potable water, physical/chemical assessment	KTW – German Standard		✓						
Growth of microorganisms on material for use with drinking water (biofilm)	examination of microbial slime formation according to a fixed procedure	DVGW-W270 – German Standard		✓			✓			
Drinking water installations on- and offshore	migration of substances from the coating into drinking water, according to Norwegian Food Control Authority	Folkehelse Instituttet Norway		✓			✓			
Food grade ≤ 40°C	migration of organic substances from the coating to foodstuffs of neutral, alcoholic or acidic type - microbiological and physical/chemical assessment	Foodstuffs and Consumer Goods Law – German Standard					✓			
Components for swimming water (open air, indoor, warm whirl-pool) ≤40°C	chlorine absorption and release of substances from the coating	KSW – German Standard					✓			
Salt spray test	constant sprinkling with 5% NaCl-solution, afterwards examination of corrosion creeps	DIN EN ISO 9227:2006-10	≥ 10.000 h	≥ 10.000 h	≥ 10.000 h	≥ 10.000 h	≥ 10.000 h	≥ 10.000 h	≥ 10.000 h	≥ 10.000 h
Thermo-shock-test from 180°C to 0°C	30 minutes at 180°C, 30 minutes at 0°C, 1.000 cycles	IEC 60 068-2-14	✓							
Autoclave test with explosive decompression (natural gas, 100 bar, 100°C)	decompression from 100 to 50 bar in 5 minutes, following from 50 bar to standard pressure in 10 minutes – 4 cycles	individual test		✓				✓		
Cathodic disbondment test	cathodic disbondment test at 1,5 V and electrolyte solution of 60°C	ASTM G42-96	✓	✓	✓	✓	✓	✓	✓	✓
Performance requirements for protective paint systems for offshore and related structures	25 week cycles: 3 days UV radiation and condensation + 3 days salt spray + 1 day extreme temperature shock at -20°C, afterwards examination of corrosion creep	ISO 20340	✓	✓	✓	✓	✓	✓	✓	✓
Ballast water tanks	refurbishment of ballast water tanks	Germanischer Lloyd, Germany					✓			
E 85 – ethyl alcohol, methyl alcohol/ petrol, add-blue-solutions, RME	1.000 hours storage in each liquid at 23°C	individual test	✓	✓	✓	✓		✓		
Resistance to Coolway E 32 – cutting fluid	4 days storage at 23°C	individual test	✓	✓	✓	✓	✓	✓	✓	✓
Resistance to 100% methyl alcohol	1.000 hours storage at 40°C	individual test	✓	✓	✓	✓		✓		
Resistance to deionate, fully demineralized water	long-term test, 1 year constantly storage at 50°C	individual test	✓	✓	✓	✓		✓		
Saudi Aramco-Standards	highly chemical resistance combined with extreme pressure resistance at operating temperatures up to 150°C	APCS-2i / APCS-28 / APCS-117						✓		
H_2SO_4 solutions (30% and 50%) and saturated NaOH solution	1.000 hours storage in each liquid at 50°C	individual test	✓	✓	✓	✓		✓		
„Killer solution“ - 98% H_2SO_4 / pure methyl alcohol / 3 % NaCl-solution, each 1/3	>9.000 hours storage at 50°C	individual test, ongoing			✓	✓				

Research and Development

Improvement through innovations

An important part of our company philosophy is the new development of coating products for special demands.

Through extensive and continuous research work, we are constantly improving the quality and the range of our product portfolio. Therefore we also provide adequate coating solutions for specific niche markets.

One of our research projects has been successfully completed. As single manufacturer, Ceramic Polymer features internal coatings for biogas plants and storage tanks for crude oil and all kinds of hydrocarbons against anaerobe biocorrosion induced by SRB bacteria. The specific functionality of this product line is internationally registered for patent. Thus, fatal pitting corrosion is effectively and long-lasting avoided.

According to experts 20% of all costs caused by corrosion are based on microbial destruction of the material. It is high time to employ our innovative coating product effectively in this scope.

Our innovative internal coatings provide long-term protection against biocorrosion induced by SRB bacteria.

According to Patent-No. WO 2011/000339 A2

What happens exactly during the anaerobe biocorrosion by SRB bacteria? Very complex reactions occur on the metal surface. In our topic "Biocorrosion" you can get an overview, but here we would like to explain the process in detail.

First phase of biocorrosion: First population by oxygen tolerating SRB

The first population takes place by oxygen tolerating SRB. This occurs in oxygen-containing areas, but at a moderate speed ("hibernation"). These oxygen-tolerating SRB proliferate best in areas without convection. They find the niches with less circulation in lower areas of oil tanks and in cracks and pores of the coating. Thus, every area of storage tanks and even pipelines can be populated. These oxygen-tolerating SRB produce enzymes such as catalase and superoxide dismutase which form an aggravated lack of oxygen.

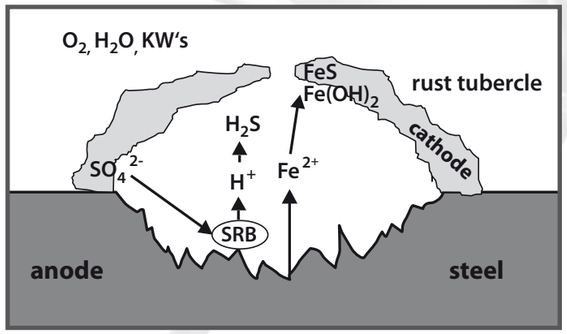
Second phase of biocorrosion: Formation of tubercles and resulting destruction of iron

In these aggravated anaerobe areas, sulfate reducing bacteria (SRB) grow extremely fast and produce for the preservation of their O_2-independent metabolism hydrogen sulfide (H_2S). The SRB settle down primarily as tubercle-shaped colonies. Next, the physical-chemical conditions near the ferrous surface of the tank alter. Whereby the enzyme hydrogenase, which is produced by SRB, the resulting iron(II)sulfide (FeS) and the hydrogen film caused by autoprotolyses of water are important.

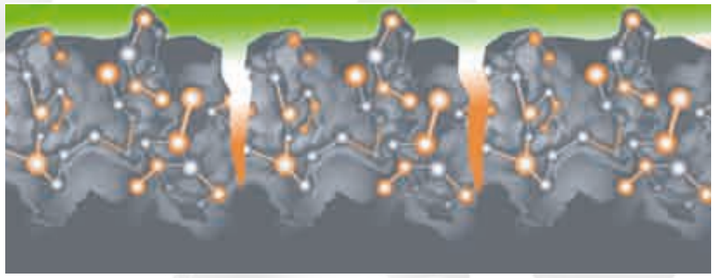
The enzyme hydrogenase dismantles the protecting hydrogen film and releases the hydrogen as an electron donor. Hence, the above discribed redox reaction begins, where mainly iron is oxidized to iron-2+ and sulfate is reduced to sulfide. The iron-2+ions are intercepted by sulfide-ions to iron(II)sulfides and build a black crust around the rust tubercles.

The emerged iron(II)sulfide turns into a cathode and the galvanic cell iron / iron sulfide develops (conversion of chemical into electric energy). The hydrogen could reduce the electric potential of this cell, but the enzyme hydrogenase impedes also this protective mechanism and regenerates the layer of iron(II)sulfide constantly.

Evidentially anaerobe biocorrosion causes a 10-times higher oxidation rate in comparison to atmospheric corrosion.



Picture: *Simple illustration of the processes in a rust tubercle. The building of tubercles is a microbial induced complex process.*

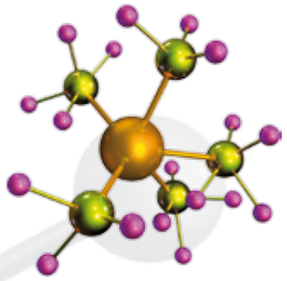


Picture: *Effect of our tank lining product. As soon as micro cracks occur in the coating, the special biocide crystals burst and unfold their effect within the whole crack. The SRB are killed before their settlement. The existing depot effect causes a long-lasting biocidal corrosion protection without localized erosion.*

Why does the unique Ceramic Polymer coating systems provide a long-term protection against SRB- induced biocorrosion?

The description of the biocorrosion processes shows that it is primarily important to avoid the first population of oxygen tolerant SRB bacteria to prevent building of rust tubercles and resulting biocorrosion. The internationally patent pending functionality of integrated special biocide crystals into the ceramic polymer matrix destroys the SRB bacteria before they can settle in micro cracks which have occurred. Extensive test series by an independent institute have proven clearly that most thorough prevention of SRB-induced biocorrosion is provided by using our special products.

Conceptions and intentions...
...which we put into practice!



We give you the opportunity to get a short insight into our development activities. Within these fields we can demonstrate proven precise research methodologies.

- Long-term protection against aerobe biocorrosion.
- Bacteria are killed through disinfection of contact areas. By touching specific coated surfaces biocides are activated to prevent germ formation.
- A specific coating for the reduction of gamma rays by using new types of fillers with reflection and absorption properties.
- Development of internal coatings for highest pressure resistance of more than 500 bar for special applications.

We would gladly keep you informed of the results of our tests, as well as facts about new and further developments of our innovative coating systems.

Ceramic Polymer GmbH | Daimlerring 9 | D-32289 Roedinghausen | Germany

Phone: +49 (0)5223 – 96 276-0 | Fax: +49 (0)5223 – 96 276-17 | eMail: info@ceramic-polymer.de | Web: www.ceramic-polymer.de