borer
advanced cleaning solutions

WHITEPAPER

deconex® MT 41
Reinterpreting the passivation process

For conventional immersion and spray application as well as innovative vacuum processes

borer industry

Successful passivation

begins with the right preparation

**You don‘t hear it coming, it isn‘t immediately visible, it happens insidiously and every production manager is happy if it doesn‘t set in:
we‘re talking about unwanted oxidation (rust). With a combination of the right system technology and the innovative passivation method developed by Borer Chemie AG, products can be effectively protected during? the manufacturing process.**

Ensuring resistance to corrosion on metal materials is essential for avoiding undesired oxidation. The long-term legibility of product markings for complete traceability and permanent resistance to corrosion are guaranteed with this passivation method. Complex shapes, demanding materials and new technologies such as additives, pose a particular challenge for production.

> Passivation is a conditioning process.

What exactly is passivation

Often, the process is associated with surface protection such as coating (anodising, burnishing, etc.), a layer of oil on the metal surface or similar applications. This application has nothing to do with the actual passivation process, however! Passivation is a conditioning process. In surface technology, this means that a protective layer forms spontaneously or is generated deliberately on a metallic surface through the use of the correct medium, e.g. deconex® MT 41. This protective layer prevents corrosion of the base material or significantly slows it down.

The importance of pre-cleaning

Metallic products that must guarantee long-lasting protection for their future use are chemically passivated. Before passivation, however, it is essential to create a clean and residue-free surface. High-quality preliminary cleaning is therefore so important because the passivation media will only be able to trigger a reaction at the places where direct contact with the metallic surface can be guaranteed. Long-lasting protection cannot be guaranteed even with passivation if the surface is not clean before the passivation process.

The 7-step cleaning concept

Borer Chemie AG has developed its own deconex® cleaning concept for its customers, including passivation for the high demands of the production process. This can be used on different system technologies such as immersion or spraying, but also with the new vacuum process. The cleaning concept is based on a structured, 7-step procedure in which the customer‘s requirements are documented and used to develop a cleaning and passivation method optimised to the customer‘s specific needs.

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7-step procedure towards structured process development

For the most demanding situations

deconex® cleaning agents take into account manufacturers' high standards and are developed on a customer-specific basis to be implemented at the customer's site. Depending on the industry, undesirable ingredients that are difficult to rinse off are completely dispensed with. This significantly reduces the risk of contamination from process media on the one hand, and on the other ensures process reliability since residue (process chemicals and production residue) can be removed very effectively. Ultimately, the process delivers reproducible results.

The deconex® product portfolio is rounded off with the new passivation method which shows better results compared to the conventional nitric and citric acid methods well known on the market.

Test your processes and our deconex® cleaning agents
on various types of equipment in our test and training centre, which is unique in Europe

Test- und Trainingscenter

The deconex® MT 41
passivation solution

deconex® MT 41 is a highly acidic passivation agent with a pH of 2.2 containing phosphoric and nitric acid as well as non-ionic surfactants.

The advantage of this passivation solution lies in the fact that, compared to immersion passivation with nitric acid (HNO_3), it can be used at significantly lower concentrations. Thanks to the lower concentration of 0.02 to 0.12% vol., deconex® MT 41 can be used for conventional immersion passivation as well as for the new, more economical method of spray passivation and especially for passivation using under vacuum. The temperature range extends from 20 to 85°C. High temperatures are essentially important for the efficiency of the passivation process since chemical reactivity increases at higher temperatures. Conventional passivation processes based on nitric acid cannot be used under vacuum or spray methods due to the temperature variables, gas formation and foaming behaviour. Safe use would be unlikely.

Generally speaking, the novel passivation solution can be used successfully for the passivation methods mentioned (spray, immersion and vacuum) thanks to its low concentrations.

Compared to conventional immersion passivation with nitric acid, the passivation method with deconex® MT 41 is not only more economical, but it is also more ecological and user-friendly.

The solution is biodegradable and, thanks to its low concentration, can be disposed of via the normal wastewater system if local wastewater regulations permit this.

Examples of use

Spray application

Process	Dosing	Temperature	Reaction time
Primary passivation (Long-term passivation)	2%	RT – 85° C	30-60 min.
Secondary passivation (short-term passivation)	2%	RT – 85° C	5-30 min.

Immersion application

Process	Dosing	Temperature	Reaction time
Primary passivation (Long-term passivation)	8–12%	RT – 85° C	30-60 min.
Secondary passivation (short-term passivation)	8–12%	RT – 85° C	1–30 min.

Process temperature and exposure time are to be finalised according to the customer's requirements.

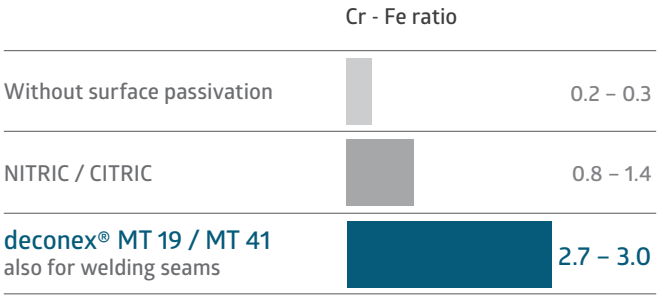
« The passivation method with deconex® MT 41 is environmentally and user-friendly »

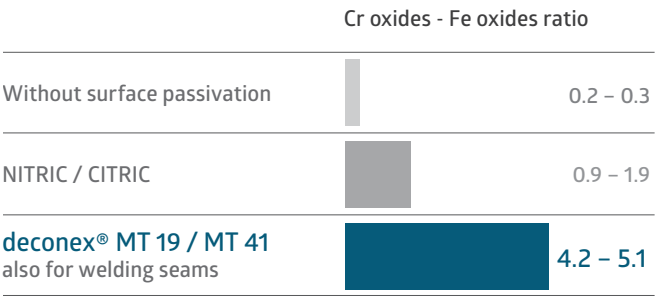
A passivation process with measurable added value

The passivation process developed by Borer Chemie was compared with other passivation media from an economic and ecological perspective, as well as in terms of material compatibility, and delivers measurable added value. Passivation with deconex® MT 41 was also compared with conventional passivation methods from the point of view of the formation and extent of the oxide layer. This resulted in the following findings:

The illustration shows that a very high ratio of Cr-Fe and Cr oxide - Fe oxide has formed on the surface compared to the application involving nitric / citric.

The results achieved with deconex® MT 41 can also be used as reference for welding seams, which are comparable in principle to additive manufacturing.





The benefits of a correct application of the passivation process

+ Increasing corrosion resistance by strengthening the passive layer
+ Removal of foreign metal impurities (“metallic purity”)
+ Extending the life of metallic products
+ Biocompatible surfaces through passivating oxide layer

The advantages of deconex® MT 41
compared to nitric acid

Nitric acid is a tried-and-tested process medium which ensures passivation of the metal surface. Its advantages and disadvantages are well-known:
it is recognised, for example, that a good formation of the oxide layer is guaranteed and that the process is approved in medical technology, for example, according to the ASTM A987 standard. The known disadvantages of nitric acid include the loss of contrast on labels and, as a consequence, reduced legibility, the formation of nitrous gases, a high concentration of chemicals and laborious wastewater and exhaust air handling routines. In all of these cases, the use of deconex® MT 41 brings added value to the passivation process.

The comparison of the nitric acid and deconex® MT 41 passivation media shown below highlights the advantages of using deconex® MT 41:

Nitric acid	deconex® MT 41
Chemicals	
Nitric acid	Nitric acid, phosphoric acid, non-ionic surfactants
Nitric acid concentration in the process tank between 20 to 45%	Chemical concentration from 0.02 to 0.12% concentration in the process tank
Essentially, both methods fulfil the requirement from the ASTM A967 standard. However, deconex® MT 41 puts less strain on the material and the labeling and legibility is guaranteed. Both processes contain nitric acid, whereby the product deconex® MT 41 is used at a 1000-times-lower concentration compared to passivation with HNO_3.	
Plant technology	
Process tank made of PVDF	Process tank made of PVDF or stainless steel
Only applicable in immersion process	Applicable in immersion, spray and vacuum process
Existing equipment can be used when using deconex® MT 41. It is also now possible to use the passivation process with the spray or vacuum method. This brings new opportunities for process design, e.g. cleaning and passivation in a single sluice function.	
Material compatibility	
Stainless steel, titanium and titanium alloys	Stainless steel, titanium, titanium alloys, carbon, PEEK, silicone, Teflon, various plastics
Material compatibility is also an added value through which procedures in production can be optimised. Ready-assembled products that contain different materials can be passivated as a single unit. In this case, we are referring to instruments that contain a combination of stainless steel, titanium, titanium alloys, carbon, PEEK, silicone, Teflon, various plastics, etc.	
Rinsability (removal of chemicals)	
Poor rinsing behaviour due to high concentration Danger of acid residues/stains, oxidation	Excellent rinsing behaviour due to low concentration Low risk of acid residues
Everything applied to the surface must be removable again, including the chemicals. Thanks to its composition and low concentration, the product can be rinsed off with excellent results, ensuring residue-free cleaning / passivation. When deconex® MT 41 is used, no neutralisation (acid dip) is needed either.	
Waste water treatment	
Neutralisation and precipitation of heavy metals required	deconex® MT 41 can be neutralised and disposed of in accordance local regulations
Depending on the process application and stand time of the process basin, the precipitation of heavy metals during waste water treatment may be unnecessary.	

New possible applications and advantages in the passivation process

- deconex® MT 41 is the only passivation medium that allows application under vacuum
- Application with the spraying processes
- High/broad material compatibility
- Application at low concentrations
- Very low nitrous gas formation
- Cleaning and passivation is possible in the same working chamber (spray application)
- Can be used in a airlock (tunnel) function

The essential points summarised

The passivation process from Borer Chemie AG has is using a 1,000-times lower concentration of acid than conventional methods. Nevertheless, a thicker inert layer is quickly formed which ensures that the products are protected from possible corrosion.

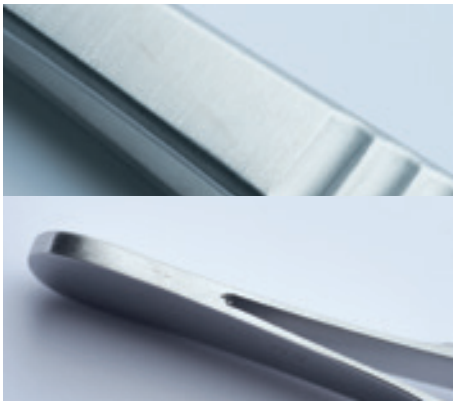
Laser-marked labels and their contrast are less stressed by passivation with deconex® MT 41, so legibility with the naked eye remains guaranteed.

deconex® MT 41 is biodegradable and does not require the handling of precipitates (heavy metals) which may occur in the conventional methods. The used solution can also be easily neutralised and disposed of in accordance with the law.

Alongside conventional immersion baths, the passivation method can also be used in closed spray cleaning systems or in processes, which are using vacuum. This opens up entirely new possibilities in production processes and the associated zone concepts.

Without passivation

With passivation with deconex® MT 41



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