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BTT – Selective Finishing

- Product Support High End -

Application Guideline 04/ 050107

Process: **Aurotech CNN, SIT, HP, AuNic**

Subject: **Working principle of Protektostat**

The reaction mechanism of Electroless Nickel plating depends on the use of a reduction agent as the source for electrons to reduce the Ni-ions in an aqueous solution on catalytic areas (Pd activated Cu-pads).

$$3\ NaH_2PO_2 + 3\ H_2O + NiSO_4 \rightarrow 3\ NaH_2PO_3 + H_2SO_4 + 2H_2 + Ni^0$$

Due to this reaction mechanism it is easy that the electroless Ni plating can happen on other areas which are getting catalytic. Especially the Ni tank and all immersed equipment parts are prone for this plating due to various reasons (e.g. rough areas in the tank, catalytic tank material, catalytic equipment material, parts exposed to friction, loose Ni-particles from poor basket handling). This additional plating area will lead to additional consumption and even worst to improper Ni plating conditions due to the increase of active plating area.

Stainless steel as tank material is used for ensuring the full lifetime of the Ni-bath in one tank. In general stainless steel is catalytic but with a passivation layer the Ni plating can be avoided. This passivation layer is created by the use of a oxidizing acidic solution. Commonly Nitric acid is used .

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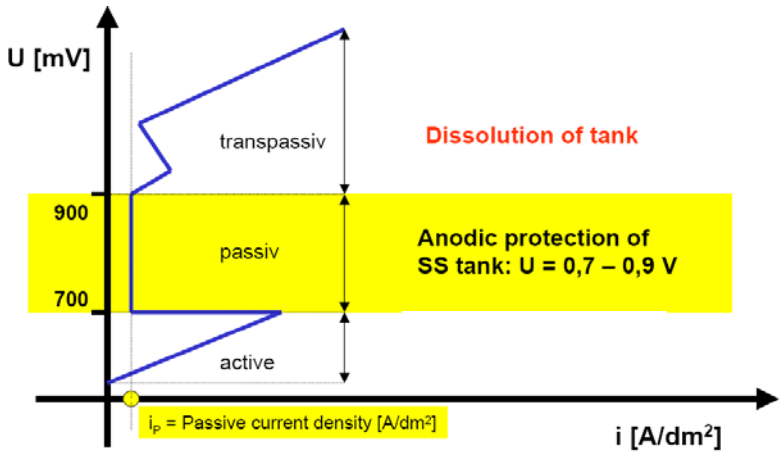
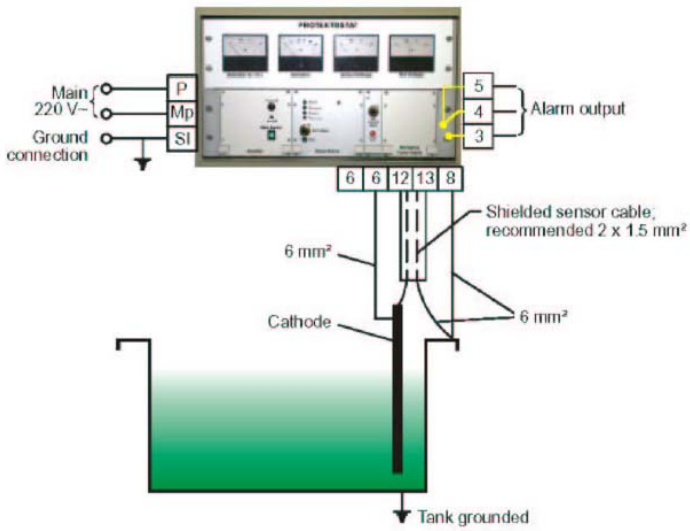
To keep the passivation layer functional over the lifetime of the Ni-bath, it is necessary to keep a anodic potential on the tank wall as well as on all immersed parts which ensures that the tank potential is in the passive area.



The necessary anodic potential is applied by using the Protectostat SST. For detailed handling and electrical connection please refer to the manual Protectostat SST .



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By applying a constant potential (0,5 V higher then the measured potential of the system without external polarisation, in general ~ 0,8V) to keep the passivation layer, the current will be higher as older the Ni bath life will be. The Protectostat is adjusting the necessary current to keep the set Potential automatically. After reaching a certain current value (in general 1,5 – 4 A, depending on bath geometrie, volumina,electrolyte etc.) the bath must be pumped out to avoid plate out. Afterwards the following procedure has to be carried out to remove possible Ni seeds and to ensure the build up of a sufficient passivation layer :

Nickel tank stripping/passivation procedure

1. Check exhaust system carefully!
2. Turn off Protectostat/rectifier!
3. Fill half tank volume with water
4. Fill up tank to level with HNO_3 by immersing a hose below water surface
5. Cover the tank, then turn on circulation
6. Heat up to 40 – 50 °C (45 °C = setpoint)
7. Strip/passivate for 16 hrs.
8. Turn on air agitaition while cooling down to RT (prevent residues in tube)
9. Pump stripper solution in storage tank
10. Rinse tank and piping, including air sparger several times (turn on circulation pump)
11. Check pH in tank until same as pH of fresh water

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To ensure a sufficient functionality of the system the below mentioned recommendations should be taken in consideration:

Tank

Surface: Electropolished **Material: WN 1.4571 (AISi 316 Ti)**

To attain a smooth surface, which reduces the potential of seed growth.

Electrodes (rods)

Material: Regular steel or stainless steel

Surface: Sand blasted or roughened

Fixing: Perfect isolation required

If passivation problems of the rod appear, remove rods during stripping the tank or/and plate them with nickel.

Wires from tank and rods to rectifier

Material: Copper, area should be at least 6 mm^2

Connections: Risk of corrosion → Check frequently !!!

If distance from tank to rectifier is longer than 10 m, use larger cable area.

- All parts in contact with the Ni-electrolyte must be made of stainless steel (including piping, filter housing, immersed heater and sensors, etc.) and connected to the same potential

- It is recommended to use a cathode in each corner of the Ni tank to ensure a sufficient potential at all areas

- Additional it is necessary that electrical shielded areas in the Ni-tank (e.g. filtration departments, outside filtration, etc.) uses a separate cathode to ensure a sufficient potential at all areas

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- It must be ensured that the protection system during the Stripping/Passivation with Nitric Acid is turned off. In case that the protection system is accidentally switched on during the treatment the stainless steel will get dissolved.

- The rinsing after passivation with Nitric Acid must be sufficient to ensure that no residual Nitric Acid is left and can contaminate the following make up, otherwise the Nitric contamination will lead to servere Ni-corrosion and willl influence the deposition speed of the Ni-bath depending on the amount of Nitric left. This can be reached by multiplre rinse and dump cycles. A suitable control is to measure the pH of the last rinsing cycle, this pH should be the same as the pH of the rinse water used for rinsing.

- The use of ammonia for neutralization is forbidden due to the fact that by using ammonia only the H^+ Ions will be neutralized and the NO_3-Ions will still be in the solution without the possibility of being detected by simple pH measurement.

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