Innovative process for ecological pickling on stainless steel welds and Electrochemical marking for decorations of stainless steel surfaces

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Spilamberto (MO) - ITALY
STAINLESS STEEL

Pharmaceutical

Food Factory

Architecture

Oil&Gas
POST-WELDING SURFACE TREATMENT

1. Restore the pre-welding aesthetic
   Complete removal of iridescence

2. Remove non-protective oxides
   Removal of iron porous oxides

3. Re passivate the treated surface
   Formation of chromium oxide on the surface

*TIG WELDING on STAINLESS STEEL*
POSSIBLE TREATMENTS

MECHANICAL
(Abrasives No Passivation)

CHEMICAL (Toxic Acids)

Electrochemical
(Electrolyte + Current)
Founded in 1995, Nitty-Gritty provides ecological stainless steel surface treatment solutions which are "down to earth", "innovative" (lot of patents) and "straightforward" (easy to use).
Nitty-Gritty's mission is to provide simple and innovative systems to improve the quality of finished products and take care of the operator safety and environment.
WELD CLEANING / POLISHING & PASSIVATION
WELD CLEANING / POLISHING & PASSIVATION

PWR GENERATOR:
INVERTER BOARD WITH P.F.C.
(ISO EN 61000-3-2)

TORCH

PAD / BRUSH
+
ELECTROLYTE

LOCAL INSTANT CLEANING / POLISHING and PASSIVATION
IMPROVE ECOLOGY & PERFORMANCE

+++ FASTER
+++ ECO FRIENDLY
+++ HIGHER PASSIVATION

Aim of our research: Obtaining an electrolyte

1 WAY: R&D TO DEVELOP NEW ELECTROLYTES:

- **PICKLING GEL** (TOXIC STRONG ACIDS)
- **FOOD GRADE ACIDS** (PURE)
- **FOOD GRADE ACIDS** (WATER BASED)
- **NEUTRAL pH SALT SOLUTION**

**pH NEUTRAL**
IMPROVE ECOLOGY & PERFORMANCE

2 WAY: R&D TO IMPROVE ELECTRONICS:

TRANSFORMER: NEVER USED
-- WEIGHT
-- NO POWER CONTROL
-- ONLY 44% EFFICIENCY

INVERTER BOARD
++ LIGHT
++ P.F.C. (ISO EN 61000–3–2)
++ 96% EFFICIENCY
IMPROVE ECOLOGY & PERFORMANCE

3 WAY: OPERATOR’S SAFETY & FIRENDLY SOLUTIONS

GLI UNICI A DAVE IL SISTEMA DI ASPIRAZIONE/SOFFIO DEI VAPORI BREVETTATO.

THE ONLY ONES WITH A PATENTED VAPOR SUCTION/BLOW SYSTEM.

I PRIMI AD AVERE INTEGRATO LA POMPA AUTOMATICA PER IL DOSAGGIO DEL LIQUIDO DECAPANTE.

THE FIRST ONES TO INTEGRATE THE AUTOMATIC PUMP TO DOSE THE PICKLING LIQUID.

LA NOSTRA CLINOX REC È LA SOLA MACCHINA AL MONDO CHE RICIRCOLA E FILTRA L’ELETTROLITA.

OUR CLINOX REC IS THE ONLY MACHINE IN THE WORLD WHICH RECYCLES AND FILTERS THE ELECTROLYTE.

GLI UNICI AD AVERE BREVETTATO LA SECONDA TORCIA CON IL SERBATOIO INCORPORATO.

THE ONLY ONES WHO HAVE THE PATENTED TANK-INTEGRATED SECOND TORCH.
RESEARCH GOALS

Mission: Develop an alternative to the standard electrolyte, more environmentally friendly and non-corrosive

- **REDUCE SOLUTION HAZARD**
- **INCREASE CORROSION RESISTANCE**
- **INCREASE WORK SPEED**

Samples: TIG welds on AISI 304 plates (100 x 100 x 1,5 mm)
BEFORE and AFTER WELDING

REF vs REF Weld
POLARIZATION CURVES

REF vs REF-Weld

SA-10P

PH-75

CITR-25P

BEST RESULTS

STANDARD SOLUTION
XPS ANALYSIS - DIFFERENT DEPTH

<table>
<thead>
<tr>
<th>NOT WELDED</th>
<th>O</th>
<th>Fe</th>
<th>Cr</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>53.7</td>
<td>25.9</td>
<td>18.5</td>
<td>0</td>
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<table>
<thead>
<tr>
<th>Atomic %</th>
<th>REF-WELD</th>
<th>PH-75</th>
<th>CITR-25P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elements</td>
<td>O</td>
<td>Fe</td>
<td>Cr</td>
</tr>
<tr>
<td>Surface</td>
<td>69.6</td>
<td>30.4</td>
<td>0</td>
</tr>
<tr>
<td>1° sputt.</td>
<td>63.1</td>
<td>36.8</td>
<td>0</td>
</tr>
<tr>
<td>2° sputt.</td>
<td>44.8</td>
<td>55.2</td>
<td>0</td>
</tr>
<tr>
<td>3° sputt.</td>
<td>55.7</td>
<td>44.3</td>
<td>0</td>
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</table>
CORROSION TESTS ( MIG SAMPLES )

RESULT COMPARISON
REAL FIELD APPLICATIONS

PHARMACEUTICAL PIPELINES
REAL FIELD APPLICATIONS

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REAL FIELD APPLICATIONS

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PHARMACEUTICAL PIPELINES
REAL FIELD APPLICATIONS

WINERY VESSELS (VICENZA – ITALY)
REAL FIELD APPLICATIONS

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REAL FIELD APPLICATIONS

WINERY VESSELS (VICENZA – ITALY)
Inox Mark: Electrochemical marking

✓ HIGH CORROSION RESISTANCE
✓ HIGH WEAR RESISTANCE
✓ EASY TO USE
✓ LOWER PRICE THAN LASER PROCESS
Common uses: CE Plates / Barcode / QR code

<table>
<thead>
<tr>
<th>System</th>
<th>Electro weldcleaner</th>
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<tbody>
<tr>
<td>Model</td>
<td>MIG.CLINOX</td>
</tr>
<tr>
<td>Serial Nr.</td>
<td>MC1006004</td>
</tr>
<tr>
<td>Manufactured in</td>
<td>2012</td>
</tr>
</tbody>
</table>

- Supply voltage: 230V
- Phases: Single phase / neutral ground
- Capacity: 3kW
- Frequency: 50Hz
- Electrode voltage (MIG): 24V AC
- Electrode voltage (TIG): 30V AC
- Tank capacity (MIG): 6L
- Tank capacity (TIG): 1.8L
Graphical / Decorative Applications
Logos / Symbos Applications
NaCl 3,5% Polarization Curves
CORROSION TEST

NOT MARKED AREA

MARKED AREA AISI 304

MARKED AREA AISI 430

NOT MARKED AREA

MARKED AREA
COLOR ANALYSIS

$L^*$: represents the brightness, it can take values from 0 (corresponding black) to 100 (corresponding to white in the gray scale);

$a^*$: expresses the red color when it is positive, it can assume values that ranging from 0 to plus infinity;

$b^*$: expresses the yellow when it is positive, it can assume values that ranging from 0 to plus infinity.
RAMAN SPECTROSCOPY

Magnetite modified by Ni

REFERENCE: Ji Hyun Kim, Il Soon Hwang, Nuclear Engineering and Design 235 (2005) 1029-1040
BAGRATI CATHEDRAL – UNESCO W.C.H. SITE
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CONCLUSION

ELECTROCHEMICAL SYSTEM ALLOWS RAPIDLY AND EASILY TO TAKE CARE STAINLESS STEEL IN ORDER TO RETAIN THE ESTHETIC, RESTORING CORROSION RESISTANCE, DURABILITY AND MECHANICAL RESISTANCE OF STAINLESS STEEL
THANK YOU FOR YOUR ATTENTION