Mobile repair of hard coated rolls and machine components
ICE Europe Technical Program, Dr. A. Barth, 22.03.2017
**Surface Treatments:** Hard chrome (including Triplex, structural chrome and Nanochrom), electroless nickel, galvanic nickel, hybrid layers, dispersion layers, thermal spray coating (HVOF, plasma, wire flame spraying), dry coating (plasma-nitriding, PVD, PACVD), various special processes are available on request | **Machining:** grinding, polishing, milling, turning, boring, etc.
Hard Chrome Coatings – Properties

- High hardness (900 – 1100 HV 0.3) and ductility
- Low coefficient of friction and anti-adhesive properties
- High wear resistance
- Good corrosion resistance
- Excellent bond strength
Hard Chrome Coatings for all industries
Motivation – Bad things happen!

- Damages by objects like Allen keys, bolts, screws or nuts that accidently get into a machine
- Wear marks on bearing locations
- etc…..

- **On-site local repair** saves time and costs compared to the disassembly and transport of large components
Motivation – Optimization Overall Costs

- Avoid scrap
- Reduce Downtime
- Increase Productivity
- Preventive Maintenance
- Recoat / Replace
- STI Mobile Repair
Local hard chrome (and nickel) plating – Working principle

1. Coating Defect

2. Grinding the defect zone to a flat pit down to the substrate material

3. Application of galvanic hardchrome in a galvanic process

4. Final grinding and polishing of the defect zone
Local tampon galvanizing – Working principle

1. Coating Defect

2. Grinding the defect zone to a flat pit down to the substrate material

3. Subsequent adding of material

Typical composition:

- Copper as filler material
- Nickel 1\textsuperscript{st} top layer
- Nickel/Cobalt 2\textsuperscript{nd} top layer
# Comparison of the different techniques

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<th>Tampon Galvanizing</th>
<th>Local Hard Chrome Plating</th>
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<td><strong>Advantages</strong></td>
<td>▪ Applicable on complex geometries</td>
<td>▪ Same properties as original hard chrome plating</td>
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<td></td>
<td>▪ Robust Process</td>
<td>▪ Very hard, erosion and cavitation resistance</td>
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<td>▪ Dense coating</td>
<td>▪ Corrosion resistant</td>
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<td><strong>Disadvantages</strong></td>
<td>▪ Far softer than hard chrome [short-term patch]</td>
<td>▪ Lower application rate</td>
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<td>▪ Limited coating thickness</td>
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<td><strong>Uses</strong></td>
<td>▪ Edges on cylinders</td>
<td>▪ Chill rolls</td>
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<td>▪ 3D-cutting dies</td>
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<td>▪ Printing cylinders</td>
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Local hard chrome plating offers a long lasting repair with the same functionality as the original coating.
Cross-sections of local hard chrome plaiting

Interface original coating and locally applied hard chrome plating

unetched
Repair coating

etched
Original multilayer coating
Cross-sections of local hard chrome plating

- Excellent adhesion on substrate material and original hard chrome plating

Both cross-sections etched
MRS by local hard chrome plating on a large roll with mirror polished surface.

Applying hard chrome repair coating

Final manual polishing
Can you spot it?
MRS by local hard chrome plating on pump shaft in hydro power plant

Before

After
MRS by tampon galvanizing on cylinder edge

Repair for dimensional restoration outside of functional surface

Applicable on complex geometries.
Thermal and kinetic energy supplied by combustion, electric discharge or gas ionization (Plasma)

- Material inserted into the hot gas stream.
- Wire, Powder, fluid solutions and emulsion.
- Metals, alloys, pseudo-alloys, ceramics, plastics, carbides....
Metal Matrix Composites are commonly used to prevent wear. Ceramic particles of WC or Cr$_3$C$_2$ are embedded in a metal matrix. The coatings are inhomogeneous and contain voids, micro cracks and oxides.

**Carbide size:**
- 0.8 – 5 µm
- Typical 3 µm
Local Hard Chrome Plating on HVOF sprayed carbide coating

Similar procedure as on hard chrome plated surface with mobile equipment

- Hard Chrome plated spot has similar hardness than the surrounding carbide coating
- Applicable on flat and curved surfaces
Local Hard Chrome Plating on HVOF sprayed carbide coating

Original thermal spray coating

Substrate material

Repair coating
Local Hard Chrome Plating on HVOF sprayed carbide coating

- Excellent bonding of the locally applied hard chrome plating to the thermal spray coating
- Excellent bonding on the substrate material

The repaired surface offers a long lasting repair with comparable properties and functionality as the original thermal spray carbide.
Summary

- Mobile Repair Service can be applied on-site, on a large variety of components and on short notice.
- Local hard chrome plating is a repair method to regain the same properties and functionality of a component as with the original coating.
- Local nickel plating or tampon galvanizing is suitable for dimensional repair with excellent corrosion resistance but due to the lower hardness with limitations in the long-term durability.
- Local hard chrome plating can be applied on galvanic hard chrome and thermal spray coatings.
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