Functional hard chrome alternatives in line with legislation

CIDETEC has developed coatings that are an alternative to hard chrome, which in addition to complying with the properties of hardness, wear, friction and resistance to corrosion also comply with the applicable regulations to which the restriction of chromium VI refers.

**Concept**

Hard chrome plating has been one of the most commonly employed processes to obtain coatings with good properties with respect to their capacity to resist the most extreme conditions, while maintaining its quality, in very varied industries. An additional advantage is that it is a simple, versatile and cheap process. The main inconvenience is that due to the presence of hexavalent chromium in its formulation it is classed as carcinogenic by the International Agency for Research on Cancer (IARC) and regulated by REACH, which has forced us to find an alternative coating.

In order to respond to this need CIDETEC has developed multilayer coatings using electroless nickel, composite electroplating processes and coating using nickel and tungsten, which all show high resistance to wear and abrasion. They have anticorrosive and innocuous properties which enables their use as a real alternative to the current coatings made of hard chrome.

**Our approach**

**INTERNAL DEVELOPMENT**

**Cooperation projects with companies**

**ELECTROLESS NICKEL**

Ni electroless coating cryofracture.
Composites

Composite coatings are obtained by including particles (usually polymeric, ceramic or oxides) in an electrolytically deposited metal matrix. These coatings synergistically combine the properties of the two materials to obtaining a coating with superior properties to each component.

CIDETEC has developed formulations based on nickel/silicon carbide (Ni/SiC), cobalt/chromium carbide (Co/CrC), nickel/tungsten carbide (Ni/WC) and nickel/alumina (Ni/Al2O3) composites, all with excellent wear and abrasion resistance.

Nickel-tungsten coatings

CIDETEC has developed NiW formulation that has excellent hardness properties and corrosion resistance, even at high temperatures, as well as an electroplating process adapted to its characteristics.

**NIW ADVANTAGES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Hard chromium</th>
<th>NiW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-treatment</td>
<td>In the hard chrome bath, this process can generate problems with high-alloy steels</td>
<td>Degreasing and stripping line. By controlling the process parameters it is possible to treat high alloy steels</td>
</tr>
<tr>
<td>Efficiency</td>
<td>20-25 %</td>
<td>45-50 %</td>
</tr>
<tr>
<td>Thickness</td>
<td>Between 25 and 100 µm. For pieces that require a thickness between 80-300 µ</td>
<td>Good property results with a thickness of 25-30 µ. Allows later correction using a higher thickness (tested approx. 100 µ)</td>
</tr>
<tr>
<td>Hardness</td>
<td>800 - 1000 Hv</td>
<td>1100 Hv with heat treat-ment at 400 °C for 1 hour</td>
</tr>
<tr>
<td>Uniformity of deposit</td>
<td>Accumulation in zones of high current density</td>
<td>Good uniformity</td>
</tr>
<tr>
<td>Adherence</td>
<td>Easily propagation of cracks. Poor on sharp edges</td>
<td>Good on all surfaces of the piece. Tested on steel (type P1 and F124)</td>
</tr>
<tr>
<td>Abrasion/wear at 10 000 cycles</td>
<td>Good. Taber Index: 3.8</td>
<td>Slightly superior to hard chromium. Taber Index: 5.4</td>
</tr>
<tr>
<td>Corrosion resistance</td>
<td>Resistance inferior to 200 h neutral salt spray for coatings of 25-30 µ</td>
<td>Excellent. More than 400 h in neutral salt spray for coatings of 25-30 µ</td>
</tr>
</tbody>
</table>

**Opportunities**

Chemical and Petro-Chemical Industry
Aerospace
Mining
Automobile Industry
Moulds and Matrixes

**COMPOSITE COATINGS ON AERONAUTIC GEARS**

**ALUMINA PARTICLES INTEGRATED IN THE COATING**

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