Endurance Wear Coatings
Mumbai
What We Are / What We Do

- EWS LLC brought the newest thermal spray technology to the Domestic Market.
- Our HVAF|HVOF coatings bring unprecedented hardness, adhesion and ductility combined to protect equipment from WEAR & CORROSION
- We provide the Best Cost of Ownership of the coated parts reachable with thermal spray coatings
1) **Tungsten Carbide Cobalt Chrome**  
**WC-10Co-4Cr**

HVAF WCCoCr 86/10/4 - excellent resistance to sliding wear, cavitation, and abrasion. Hardness 1250-1600+ HV

Good corrosion resistance except in high PH environment and in presence of hydro fluoric acid solutions.

**Typical Applications**

- Steel rolls
- Corrugated rolls
- Wire capstains
- Calender rolls
- Sucker rods
- Exhaust fans
- Conveyor screws
Erosion Rate of Different Coating Types

<table>
<thead>
<tr>
<th>Coating Supplier</th>
<th>Average Erosion Rate (mg/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supplier A</td>
<td>19</td>
</tr>
<tr>
<td>Kermetico</td>
<td>6.23</td>
</tr>
<tr>
<td>Supplier C</td>
<td>12.75</td>
</tr>
<tr>
<td>Supplier D</td>
<td>20.1</td>
</tr>
<tr>
<td>Supplier E</td>
<td>59.35</td>
</tr>
<tr>
<td>Supplier F</td>
<td>23.1</td>
</tr>
</tbody>
</table>
2) WC-Co Tungsten Carbide Coatings

**WC-Co (88-12 Co)**

- HVAF WC-Co coatings are non-permeable to gas and liquid starting from 50 microns.
- Tungsten carbide WC-12Co is resistant to sliding wear, impact, abrasion and fretting at temperature up to 510°C preferably in non-corrosive media.
- This tungsten carbide coating can be used in dry, non-corrosive environments.
3) Chromium Carbide Coatings
Cr3C2 – NiCr

- Chromium carbide coating against elevated temperature (750°C) wear due to the high wear resistance afforded by the hard carbide particles and the high temperature oxidation nature. Hardness 1100-1200 HV

Typical Applications
- Hydraulic rods
- Steel rolls
- Wear plates
- Boiler tubes
- Downhole tools
- Pump components
4) Stainless Steel Coatings

- HVAF stainless steel coatings - barrier protecting steel components against corrosion in sea water, corrosive solutions such as mineral or organic acids.
- These coatings are suitable for resistance to abrasive wear, corrosion and erosion.
- **Alternative to flash chrome coatings.** A lower cost alternative to 86 - 10 - 4 tungsten carbide coatings.

Typical Applications

- Diesel engine valve seats.
- Wear rings and sleeves.
- Plungers.
- Water valves of FCB boiler.
5) Other Materials

Hastelloy
Stellite
Inconel
Molybdenum Boride
Copper
Aluminum
Tin
Hard Chrome Replacement

- Compared to conventional HVOF process which pioneered the development of WC-based coated materials, newly developed “HVAF” symptoms are processing higher kinetic energy and more particularly at lower temperature.

- HVAF WCCoCr is economically viable hard chrome alternative.

Other Hard Chrome Plating Alternatives.

- Numerous studies HVAF sprayed Fe-based coatings have shown their high corrosion resistance in different environments such as acid, alkaline, and chloride solutions. High-quality microstructures with low oxide content, high retention of the powder chemistry and low porosity have been reported and make this family of coatings suitable as a low-cost hard chrome replacement in many applications.
Our Capacities

Acoustic sound proof booth 9m x 4m x 3m with motorised door system

HVAF+HVOF+ SIX-AXIS ROBOT + Turn-table

Lathe machines, max capacity 18 feet long and max diameter 24 inch

5 Tons Overhead Crane
We offer one-stop wear solutions to many industries verticals by spraying cemented, WC, chromium carbide and metallic compounds. Metals and alloys coatings to resist wear and corrosion such as Super Stainless, Stellite-, Inconel- and Hastelloy-type.
Thank You
High Velocity Air Fuel (HVAF) – a thermal spray process characterized by a low combustion temperature (1,960-2,010°C | 3,560-3,650°F), high particle velocities (800 to over 1,000 m/s | 2,625-3,281 ft. /sec.), resulting in low-oxidized, ductile, non-porous high-bond carbide and metal coatings. Spray rate up to 500 g/min (66 lbs. /hr.) makes the process much faster, providing a significant advantage over HVOF.

The HVAF Gun is “a small jet engine”, combusting compressed air and LPG / propane/ propylene / MAPP fuel and generating a jet of metal particles with a velocity from 800 to over 1000 m/sec. Such particles form extremely dense and tough coatings. Our “signature” coatings are tungsten carbide coatings (WC12Co, WC-10Co-4Cr, etc.) which are non-permeable to gas and have hardness 1,400-1,600+ HV300. Regardless of their high hardness, these coatings are not brittle since decarburization or oxidation does not occur in the comparably low-temperature HVAF process.
HVAF Process Characteristics

- Lower propane flame temperature with air (HVAF) compared to pure oxygen (HVOF) – Oxygen: ~2820 °C – Air: ~1970 °C
- Higher particle velocity.
- Less oxidation • Lower porosity.
- High bond strength.
- Hard, wear resistant coatings.

The novel HVAF process enables deposition of dense, hard and wear resistant hard metal coatings with excellent technical properties.

The main benefits in HVAF are:

- Lower flame temperature vs. HVOF.
- Higher retention of carbides producing excellent coating properties.
**HVAF Coating Key Characteristics**

**Hardness DEVIATION of HVOF and HVAF WC-10Co-4Cr coatings**
They have high fracture toughness coefficient and offer good fatigue and impact resistance.

**Fracture Toughness K1C of WC-10Co-4Cr Coatings, MPa*\(m^{\frac{1}{2}}\)**

- **JP5000 HVOF**: K1C = 3.86, K1C Standard Deviation = 0.70
- **HVAF Balanced**: K1C = 6.33, K1C Standard Deviation = 0.50
- **HVAF Ultra 1**: K1C = 6.86, K1C Standard Deviation = 0.80
- **HVAF Ultra 2**: K1C = 5.60, K1C Standard Deviation = 0.15
Young's Modulus $E$ of WC-10Co-4Cr Coatings

<table>
<thead>
<tr>
<th>Method</th>
<th>$E$, GPa</th>
<th>E Standard Deviation, GPa</th>
</tr>
</thead>
<tbody>
<tr>
<td>JP5000 HVOF</td>
<td>290</td>
<td>21</td>
</tr>
<tr>
<td>HVAF Balanced</td>
<td>411</td>
<td>21</td>
</tr>
<tr>
<td>HVAF Ultra 1</td>
<td>452</td>
<td>20</td>
</tr>
<tr>
<td>HVAF Ultra 2</td>
<td>450</td>
<td>20</td>
</tr>
</tbody>
</table>

Legend:
- Green bar: Young's Modulus $E$, GPa
- Green bar with white background: E Standard Deviation, GPa
Cavitation resistance of HVAF and HVOF
• such coatings by HVAF spraying method exhibited higher hardness and sliding wear resistance compared to the one applied with HVOF.