



Wear & Corrosion Resistant Solutions for Downhole Tools

Mud Rotors • Fracture Pump Plungers • Drive Shafts • Bearing Mandrels

A Global Leader in Thermal Spray Coating Solutions

Extreme Coatings is a world leader providing wear-resistant coating solutions which are used for surface engineering in a variety of industries. Since 1996, we have been developing and deploying innovative, superior coating products and services to countries across the globe.

Our team offers an effective, solution-oriented approach which makes use of advanced thermal spray technology and proprietary coating formulations. The exceptional quality of our products has enabled them to become trade standards in the plastics and rubber industry for feedscrews, mixing rotors, tip assemblies and other parts; as well as in the oil and gas industry for downhole mud rotors and fracture pump plungers.

Successful Solutions, Impressive Results

Extreme Coatings encapsulates complex industrial components, protecting them from wear and corrosion. By increasing wear resistance, service life is increased and performance is dramatically enhanced.

We use state-of-the-art HVOF thermal spray technology to apply wear and corrosion resistant coatings. Extreme Coatings is a world leader for Tungsten Carbide Coatings on injection molding and extrusion feedscrews and mixing rotors in the plastics industry. In the Oil & Gas Industry, we are #1 in North America for mud rotor restoration and chrome plating replacement and also a leading supplier for fracture pump plunger coatings. We have coated numerous components for many industries adding major value through performance improvement and longevity.

Our focus always remains on our customers' requirements, and is demonstrated by our dedication to the resources for developing effective, successful surface engineering solutions for specific industries and equipment.

Experience & Expertise

Our industry experience has afforded Extreme Coatings the opportunity to service over 35,000 parts, and our technological expertise has equipped us with ability to offer bottom-line solutions like no other competitor in the industry. Our proprietary technologies yield a finished product that offers greater value than most all other surface engineering solutions on the market.

This competitive advantage significantly lowers our customers' operating costs through extended service life and a reduction in machine downtime. We view each job as unique, and we take pride in offering a service model that is customized to fulfill individual client needs to advance their productivity.

Typical Components Protected to Maximize Value

Oil & Gas Industry

- Mud Rotors
- Fracture Pumps
- Mandrels
- Drive Shafts
- Flow Diverters
- Bearings

HVOF-CPR Chrome Plating Replacement

Extreme Coatings' Chrome Plating Replacement (CPR) product is a wear-resistant coating line applied by the HVOF process to the entire working surface of virtually any size mud rotor. Coating options are selected based on the drilling environment, resulting in excellent resistance of extreme corrosion, abrasion and high temperatures. The dense and crack-free coating line is designed for the restoration of your carbide coated or chrome-plated rotors for use in very low to high chloride environments based on your needs, enabling optimal fleet management.

New mud rotors gain extended life, and used rotors can be brought back to life. Extreme Coatings has a unique ability to strip away most old coatings, exposing damages that can be repaired by welding and blending. After applying a standard or custom carbide coating with HVOF, majors and minors are polished to a mirror finish that further reduces friction and abrasion to the elastomer stator.

The uniformity and integrity of the HVOF process coating eliminates corrosion problems resulting from either "wash out" in the minor diameter or cracks and pits common in Hard Chrome Plating (HCP). And, due to a high concentration of carbide in the coating, the major diameter typically wears at one half the rate of HCP. These coatings allow mud rotors to be run in either high-chloride or common oil and gas drilling environments. The results:

- Maximized rotor life
- Reduced replacement cost
- Improved stator life
- Decreased cost per rotational hour
- More consistent rate of penetration (ROP)
- Substantially improved overall fleet utilization

1

Strip old chrome or carbide, weld repair imperfections, blend to uniformity

2

Coat via HVOF with our standard or custom carbide formulation

3

Polish majors and minors to <4 Ra ui mirror finish

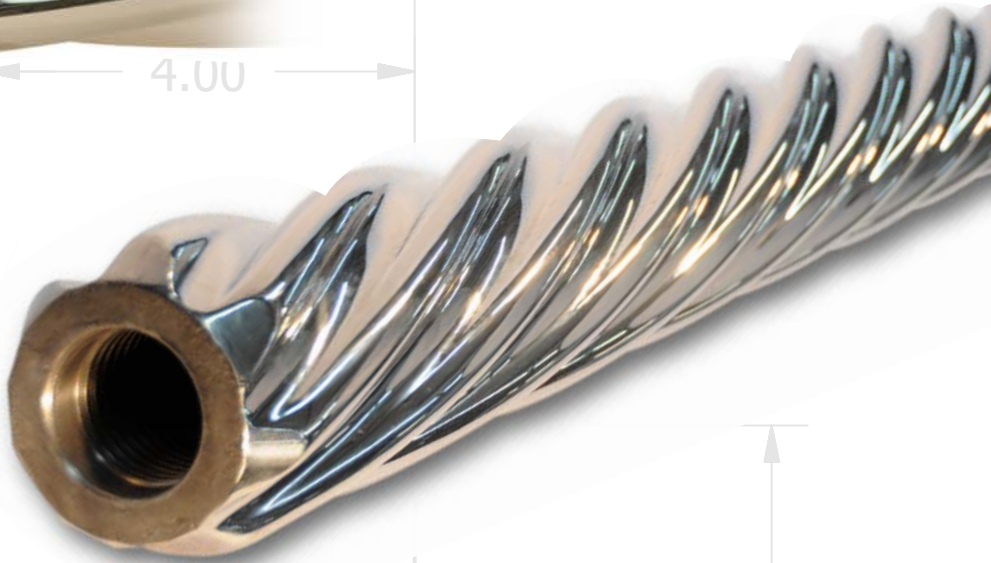
Problem

Mud Rotors coated with Hard Chrome Plating experience corrosion problems when drilling in high chloride environments due to permeation of the micro-cracks and pores, which subsequently corrodes the underlying steel.



Solution

Full Encapsulation via HVOF using our abrasion, erosion and corrosion resistant CarbideX coating formulations increase Mud Rotor performance life and reliability.



The Extreme Coatings Process



Innovation & Technology

Extreme Coatings uses HVOF thermal spray technology to apply premium wear-resistant and corrosion-resistant coatings to complicated machine parts. These coatings are hard, dense and porosity free and can be applied up to .040" (1mm) thick. Our proprietary formulations of hard carbides, ceramics and alloys achieve a degree of resistance to wear and corrosion unmatched by conventional alloys. After coating, our unique diamond grinding / polishing process provides a mirror-like finish that further reduces friction and adhesive wear. We can completely encapsulate new or used machine components.

Coating Formulas for Ultimate Effectiveness

Our coating formulations have been designed for optimal effectiveness with our thermal spray application processes. Our winning CarbideX coating formulations combine tungsten carbide and carefully selected alloys or metals to provide the most economical wear solution available. By producing coating materials from micro and sub-micron raw material we assure high bond strength with uniform conformance to the most complicated shapes and surfaces. We constantly test new formulations for a growing range of products and applications that result in even greater toughness, consistency and performance enhancement.

The **CARBIDE[®]X** Advantage

CARBIDE[®]X C1000Cr

Tungsten Carbide, Cobalt, Chrome (WcCoCr) Industry Standard Tungsten Carbide

- An original carbide formulation popular for the oil & gas industry
- OEM accepted and specified
- Exceptional abrasion & corrosion protection in all environments, especially very high chloride.
- Uniform coating thickness on minors and majors
- Fluid cutting protection in minors

CARBIDE[®]X C5000 (CPR)

Proprietary Blend of Carbides within a Nickel-Chrome Matrix HVOF Standard Chrome Plating Replacement

- Abrasion & corrosion protection in all muds
- Increased coating ductility and toughness
- Uniform coating thickness on minors and majors
- Fluid cutting protection in minors
- Universally compatible

CARBIDE[®]X C6000

Proprietary Blend of Carbon, Chromium, Tungsten, Nickel

- Increased abrasion protection over HCP
- Corrosion protection in low to medium chloride containing mud
- Uniform coating thickness on minors and majors
- Crack free coating with good ductility
- Increased fluid cutting protection over HCP
- Still competitively priced with HCP compared to value

CARBIDE[®]X C9000

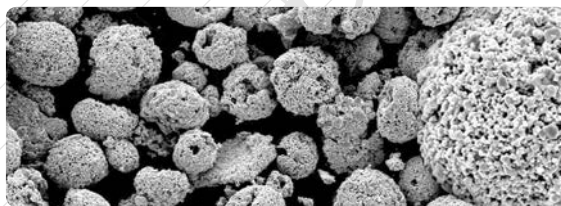
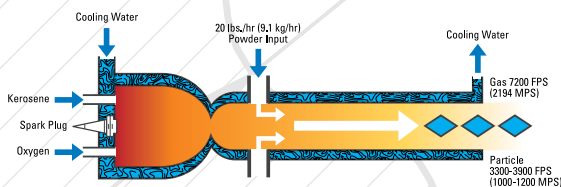
Proprietary Blend of Tungsten Carbide, Cobalt, Chrome (WcCoCr)

- An enhanced formula to our original carbide formulation (C1000cr)
- Increased abrasion protection over standard Wc
- Retains surface finish in high solid muds
- Exceptional corrosion resistance in high chloride environments

It's All in the Application: HVOF Thermal Spray Technology

HVOF (High Velocity Oxygen Fuel) thermal spray technology allows us to apply coatings with extremely low porosity and high bond strength. A mixture of fuel and oxygen are combusted within a thermal spray gun producing temperatures near 6000°F (3300°C).

Powder particles are injected into the high-pressure gas stream created by the combustion and accelerate down the barrel of the spray gun at several times the speed of sound. At these speeds and temperature conditions, semi-molten particles adhere to the substrate with superior bond strength exceeding 10,000 PSI. During coating application, the product rotates methodically in front of the HVOF thermal spray gun until the coating builds to the specified thickness. This process creates the strongest bond and highest hardness value as compared to any other thermal spray process.



Research & Development

At Extreme Coatings, our mission is to continually research and develop new technologies that benefit our clients in every industry we service. Our goal is to remain the experts in the field of metallurgy and set the bar in engineered surface solutions. Our proprietary coating formulas protect and extend the service life of your most valuable parts, saving you money and impacting your bottom line.

Other Coating Solutions

Carbide • Niboride • Flame Spray

Testing & Validation

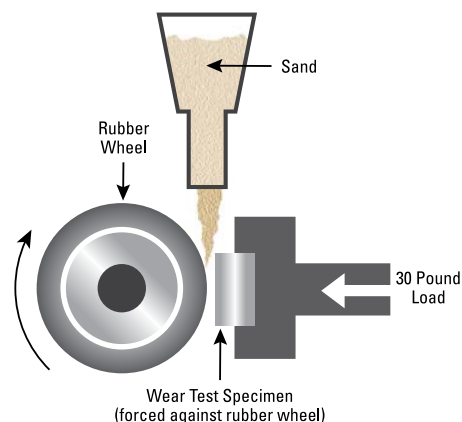
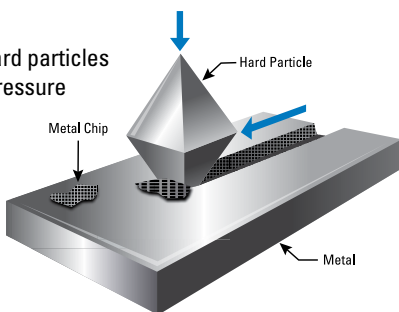
Don't just take our word for it. Third-party tests confirm our findings. Tests were performed on a variety of materials to establish a guide to performance of each when in stress and abrasion-wear modes.

ASTM G65 - Sliding Abrasion Test

The ASTM G65 test simulates sliding abrasion conditions under moderate pressure, using dry sand metered between a rubber wheel and a block coupon of the material being evaluated. The test allows comparison of wear-resistant materials by their volume loss in cubic millimeters, with materials of higher wear resistance showing lower volume loss.

Low-Stress Abrasion

Abrasive wear occurs when hard particles are compressed with normal pressure against the surface of a metal causing material removal.

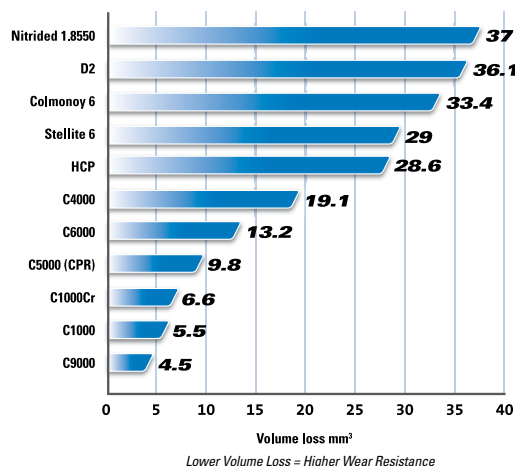


Test Conditions

Tested for 6000 revolutions at a load of 30 lb. (13.6 kg) using a 9 inch (229 mm) diameter rubber wheel and dry sand.

Coating or Alloy	Description /Composition	HRC Rc	Volume Loss mm ³
C9000	Formulation - Nano Tungsten Carbide, Cobalt	68-71	4.5
C1000	Formulation - Tungsten Carbide, Cobalt	68-71	5.5
C1000Cr	Formulation - Tungsten Carbide, Cobalt, Chrome	70	6.6
C5000 (CPR)	Formulation - Carbides within a Nickel-Chrome Matrix	65	9.8
C6000	Formulation - Carbon, Chromium, Tungsten, Nickel	60	13.2
C4000	Formulation - Chrome Carbide, Chromium, Nickel	60	19.1
HCP	Hard Chrome Plating	68-72	28.6
Stellite 6	Co/Cr/W	40	29
Colmonoy 6	Nickel-Chrome-Boron	56-62	33.4
D2	Chrome Carbide Tool Steel	58-60	36.1
Nitrided 1.8550	Nitrided Nitralloy Steel	70	37

Formulations: Our CarbideX Products



Our Range of Services

Extreme Coatings can reduce wear and increase product life for complex metal parts. In any industry where abrasion, adhesion or corrosion reduce product life, for new parts or used, Extreme Coatings has a surface solution. Here are a few pictures of various industry solutions.



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