

A person wearing a full-body protective suit and a respirator mask is using a cold spray tool to treat a large, complex metal component. The scene is set in a dark environment, possibly a factory or workshop, with the person and the metal part highlighted by a bright, glowing blue light. The person is holding the tool with both hands, and a spray of fine particles is visible emanating from the nozzle. The metal part has a complex, lattice-like structure. The overall image has a high-contrast, almost ethereal quality due to the blue glow.

VTRC[®]
METAL SYSTEMS

Cold Spray

Making Metals Work!

The Leader in Complete Cold Spray Solutions

At VRC Metal Systems, we're the world leaders in the development and manufacturing of cutting-edge high-pressure cold spray systems, meticulously engineered to exceed our customer's expectations. Our specialization provides turnkey solutions, ranging from seamless equipment installation, advanced automation, equipment servicing, and complete production integration with support of our advanced team both on-site and remote ensuring complete customer satisfaction.

Each Customer Has Specific Requirements –VRC Designs Customized Solutions To Meet Those Needs



VRC Specializes in Integration of Cold Spray to Support and Improve Our Customers Manufacturing Process

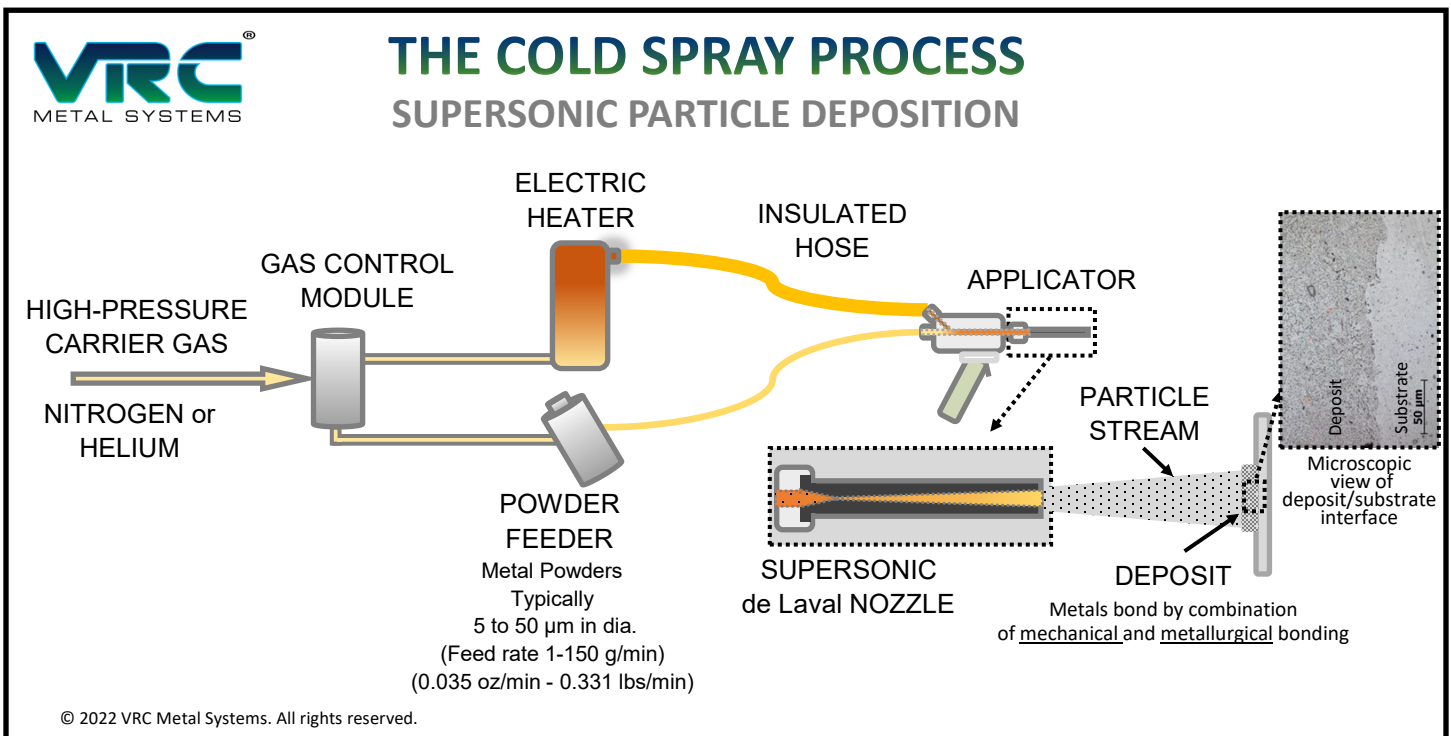


Cold Spray – The case for HIGH pressure

Cold spray, also referred to as supersonic particle deposition, is a solid-state coating process utilizing a heated high-pressure carrier gas, like nitrogen or helium, or air to accelerate metal powders through a supersonic de Laval nozzle to bond particles to a substrate. Low-pressure cold spray generates lower particle velocities, and primarily relies on mechanical interlocking with some metallurgical bonding. Low-pressure cold spray adhesion is comparable

with other traditional thermal spray processes, which operate at higher temperatures.

However, **high-pressure cold spray coatings** with higher particle velocities and primarily metallurgical bonding are anywhere from **2 to 10 times stronger than low-pressure cold spray coatings**, depending on the material deposited. High-pressure cold spray coatings can be structural, and approach wrought properties of the sprayed material.



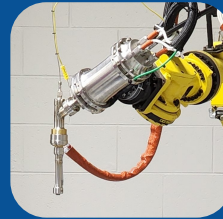
VRC not only manufactures state-of-the-art high pressure Cold Spray equipment, but also develops Cold Spray applications for our customers in a variety of industries.

The VRC Cold Spray Systems



GEN IV™

VRC Gen IV™ High-Pressure System with our new 21kW applicator heater and up to four powder feeders



VRC Raptor™ Cold Spray System



VRC® Raptor™ High-Pressure System with a Deployable 21kW Heater and Handheld Pendant



VRC® Dragonfly™



VRC® Dragonfly™ High-Pressure System with Modular Components, a 21kW Heater and Handheld Pendant



VRC Cold Spray Systems Capabilities

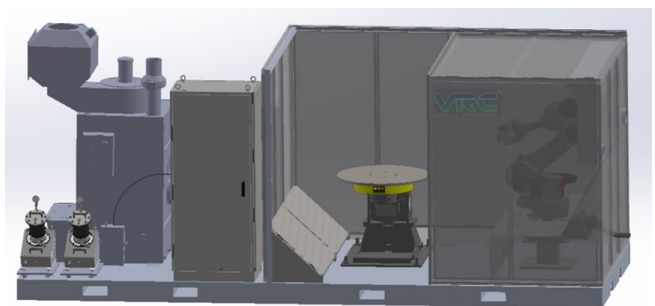
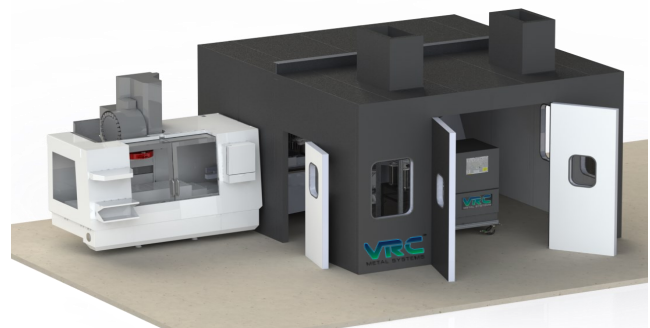
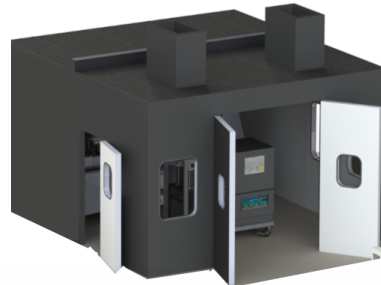
Features	Gen IV™	VRC®Raptor™	VRC®Dragonfly™
Dimensions	Electrical Module 20"x 20"x 55" (50.8cm x 50.8cm x 139.7cm) Gas Module 32"x 20"x 55" (81.28cm x 50.8cm x 139.7cm)	68"L x 32"W x 65"H (173cm L x 82cm W x 165cm H)	Electrical Module 41"L x 22"W x 12"H (104cm L x 56cm W x 30cm H) Gas Module 41"L x 22"W x 12"H (104cm L x 56cm W x 30cm H)
Weight for Portability	N/A Stationary System	900lbs (408kg)	Heaviest Component 94lbs (42.63kg)
Electrical	480 VAC, 3 PH, 50 Amps	480 VAC, 3 PH, 50 Amps	480 VAC, 3 PH, 50 Amps
Human Machine Interface	Full Touch Screen Controls	Tethered w/Full Touch Screen Controls	Tethered Pendant Parameter Readout
Heater Type	21kW Applicator Heater	21kW Remote Floor Heater	21kW Remote Floor Heater
Applicator Temp Range RT-1650°F (RT-900°C)	RT-1650°F (RT-900°C) with Cooling RT-1292°F (RT-700°C) without Cooling	RT-1292°F (RT-700°C)	RT-1292°F (RT-700°C)
Compatible with Applicator Heater	✓	✓	
Multi-Powder Feeder Standard	✓		
System Pressure up to 1000 PSI (69 Bar)	✓	✓	✓
Gas Supply: Max Input Pressure	1160 PSI (80 Bar) 5000 PSI (345 Bar) with optional regulator	3000 PSI (206 Bar)	3000 PSI (206 Bar)
Max Gas Flow 88 CFM (2500 SLM)	✓	✓	✓
Data Capture & Download	✓	✓	✓
Single or Multiple Gas Capable	Two Gas System Nitrogen, Helium or Air	Two Gas System Nitrogen, Helium or Air	One Gas System Nitrogen, Helium or Air
Gas Blending	✓		
Post Spray Printed Report	✓	✓	
Auxiliary Data Acquisition	16 Channels Additional General Purpose I/O 6 Channels—K-Type Thermocouple Inputs		
Integration with Robotics	✓	✓	
Configurable alarm package to alert operator of issues during use	✓	✓	

The VRC Additive & Subtractive Systems

VRC is the global leader in cold spray equipment manufacturing and experts at cold spray process development for both defense and commercial applications. We will match our customers with the right cold spray equipment, material, and process to make them successful.

Integrated Cold Spray Deposition Solutions:

- VRC's custom additive cold spray systems with integrated automation in an acoustical spray booth with dust collection.
- VRC's line of additive & subtractive systems with integrated CNC machining, automation, acoustical booth and dust collection.
- VRC's turnkey cold spray cell with integrated robotics and dust collection, palletized and shipped complete, ready for operation.



Compressed Gas Support Systems:

- Helium Recovery, Nitrogen Generation and Compressed Air solutions

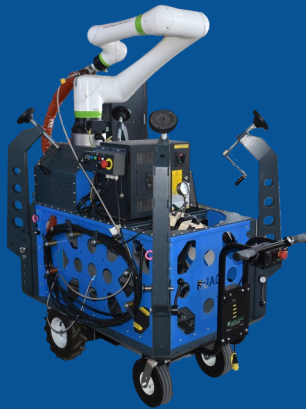
We know Cold Spray. With the VRC Cold Spray Systems, we are able to spray the full range of materials depositable by both HIGH and LOW pressure systems. If it can be done with cold spray, we can do it!

Support Equipment & Consumables



Vark™ Portable Dust Collector

- 1000 CFM (28 m³/min)
- Wet-Type 3 stage filtering system
- Integrated and powered with VRC cold spray systems



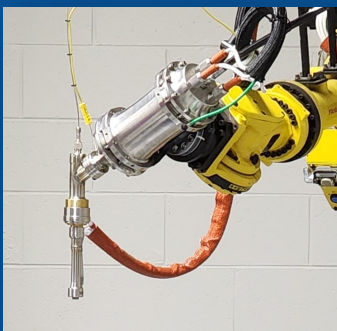
Mobile Robotic Cold Spray (MRCS) Cart

- Fanuc 6-axis articulating robot with 22 lbs (10 Bannerskg) payload capacity
- Battery-powered, manually operated 2WD cart with built-in charger
- Deployable outriggers for in-process stability
- Robot controller and pendant on-board



Portable Spray Booth

- Aluminum construction
- Acoustical paneling
- Configurable to the application
- Compatible with portable dust collector



Liquid Cooled Applicator Heater

- Useable with Raptor or upgraded Gen III™ cold spray systems
- 21kW capacity
- Internally shielded to minimize surface heating
- Water cooled nozzle to minimize fouling
- Lightweight design 33 lbs (15 kg)

VRC supports all consumable products such as, powders, nozzles and hoses.

The C.A.M.P. Site™ Cold Spray Cell

Cold Spray
Advanced
Manufacturing
Portable
SITE™



Scan the QR Code to see the full capabilities of the C.A.M.P. Site™.



Gas Storage:

- Two 12-packs of high pressure rated (4500psi) DOT bottles of compressed air totaling 11,840 cubic feet

Compressor:

- 4-Stage, air-cooled compressor
- 26.4 standard cubic feet per minute charge rate
- 20 HP 3-phase motor
- PLC equipped with HMI for user inputs



Generator:

- 125kVA output capacity
- Provides 3-phase 480 VAC power
- “Power Balance” system to maintain sufficient load on the engine



CAMP
SITE™



Brolga Trailerized Systems

Field Portable Cold Spray Systems



Brolga-002™



Includes:

- On-Board VRC®Raptor™ Cold Spray System
- Compressor
- Compressed Air Storage
- Portable Dust Collector
- MRCS Cart
- Diesel Generator
- Storage Cabinets



Brolga-003™



- Includes:
- On-Board VRC®Raptor™ Cold Spray System
- Fanuc 6-axis LR Mate Robot with Robot Controller and Pendant
- Hand-Held Applicator and Deployable Heater and Powder Feeder Allowing for Point-of-Need Sprays.

Industries Served

Aerospace



Nuclear Energy



Maritime

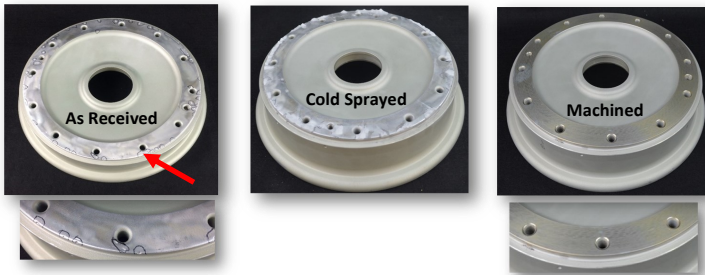


Oil & Gas



Cold Spray Solutions

Aircraft Landing Gear Wheels

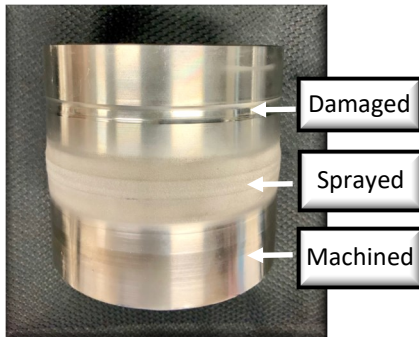


Pipe Joint Leak Repair

Leaky pipe coupling can be sealed with cold spray on-site at temps low enough that most operations can remain running



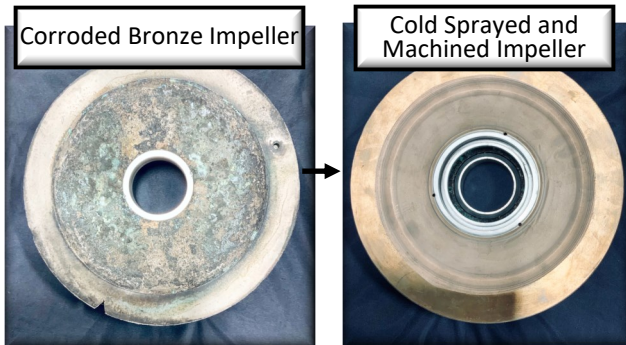
SS Shaft Defect Repair



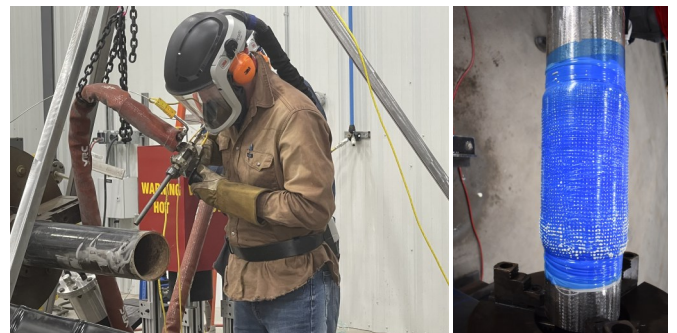
Corrosion Resistant Layers



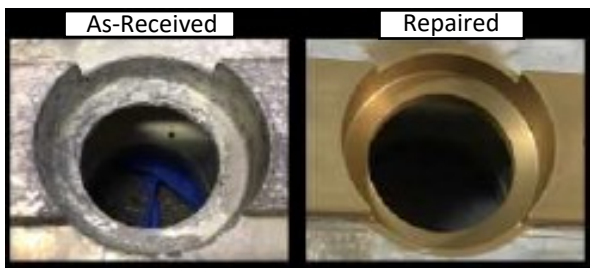
Bronze Corrosion Repair



Low Heat Thin Wall Pipe Repair



Navy Valve Actuator Repair



Wear Coatings

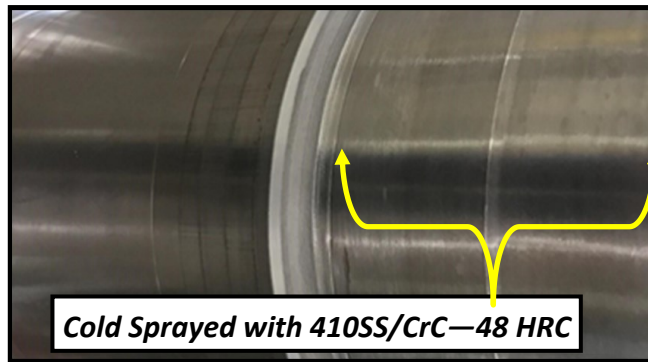


And Many More...

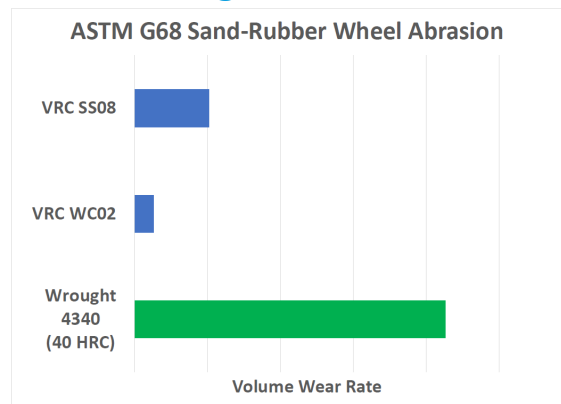
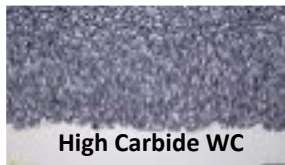
VRC cold spray equipment is saving our customers millions of dollars every year by repairing components for aircraft, ships, submarines, helicopters, missile systems, mining and industrial equipment, refineries, power plants, and many more.

Mechanical Wear Resistance

Chrome Replacement Shaft Repair



Nickel, Cobalt, and Stainless Steel Hard Coatings for Wear



Stainless Steel Blend Wear Coatings



Abrasive wear repair of an Army tracked vehicle ensuring precision, durability, and optimal performance.



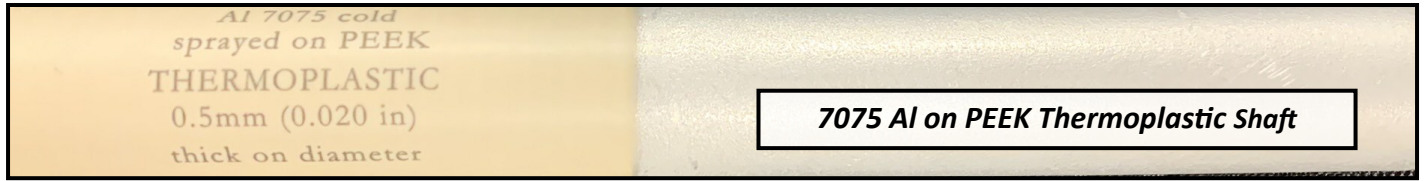
Planetary Gear Shaft wear repair with VRC's high-pressure cold spray system.



Repair wear damage on Brake Rotors, ensuring enhanced durability and reliability.

Enhancement & Specialty Coatings

Cold Spraying Metal on Thermoplastic (wear resistance or RF shielding)

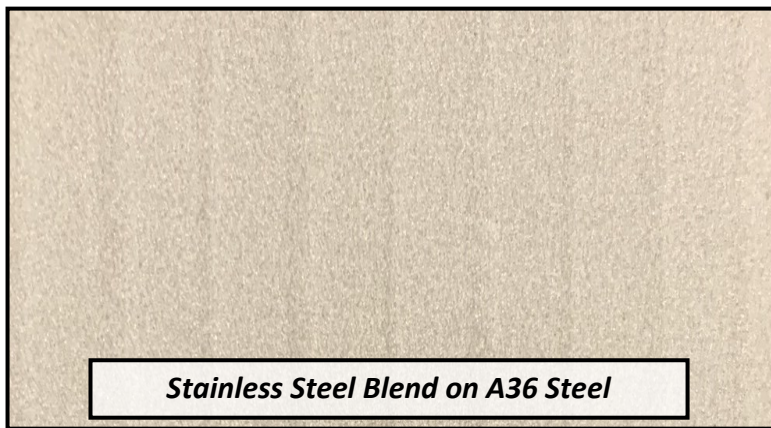


CP Ti on Thermoplastic

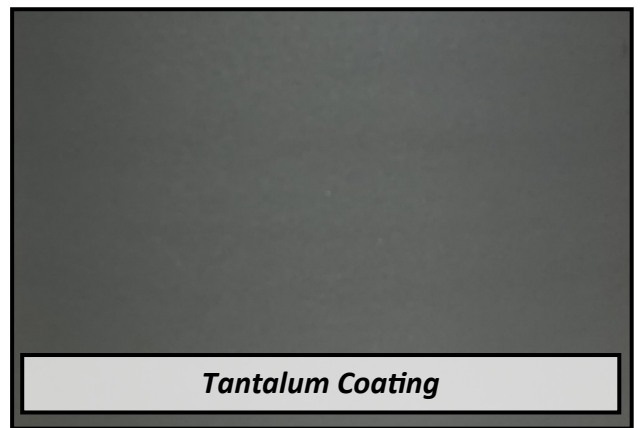


2024 Aluminum on Carbon Fiber Filled Plastic

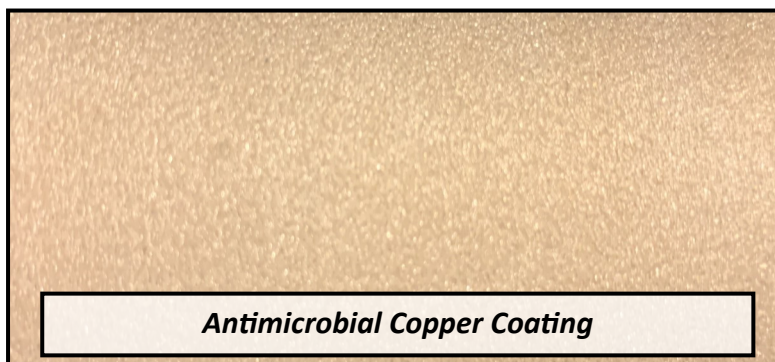
Infrared Energy Reflective



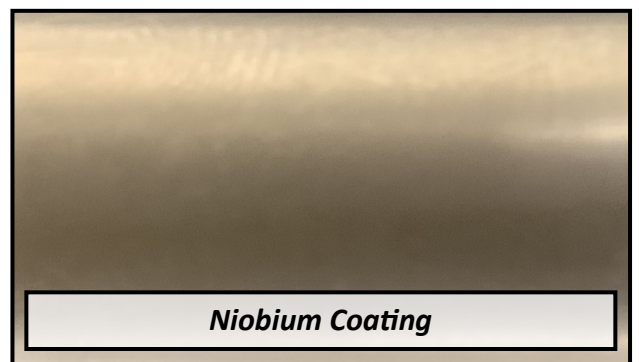
Acid and Heat Resistance



High Electrical and Thermal Conductivity



Heat and Erosion Resistance



Cold Spray Materials, Properties and Testing

Materials

Single or Mixed Powder Feeding

Unique tumbling drum powder feeder enables uniform coatings with mixed powders - does not easily separate heavier materials.

Aluminum

- CP Al
- 2024
- 6061
- 7050
- 7075
- And more

Copper

- CP Cu
- Bronze
- 90Cu-10Sn
- Cu-Ni-Inco
- Ni-Al-Cu
- And more

Titanium

- CP Ti (all grds)
- Ti-6Al-4V
- And more

Steel & SS

- 1018
- 4340
- 17-7 SS
- 316 SS
- 410 SS
- And more

Nickel

- CP Ni
- Inco 625
- Inco 718
- Stellite 6
- Mar-M-509
- And more

Specialty Powders

Carbide Coatings, Tantalum, Niobium, Chromium, MCrAlYs Blends, Silver, Tin, Babbit, Thermoplastics and more

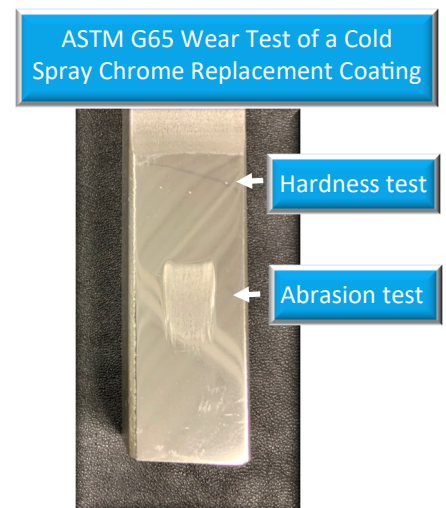
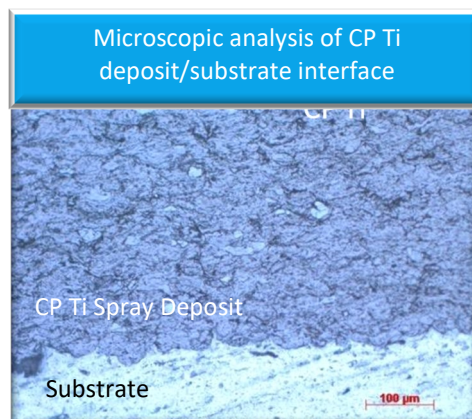
Properties

VRC high-pressure cold spray systems create deposits with bond strengths above 10 ksi (68.9 MPa) and can exceed 30 ksi (206 MPa) bond strength while maintaining less than 1% porosity, and tensile yield strength comparable to cast or wrought counterparts.

Testing

VRC can perform a wide range of material testing to ensure properties meet or exceed customer requirements.

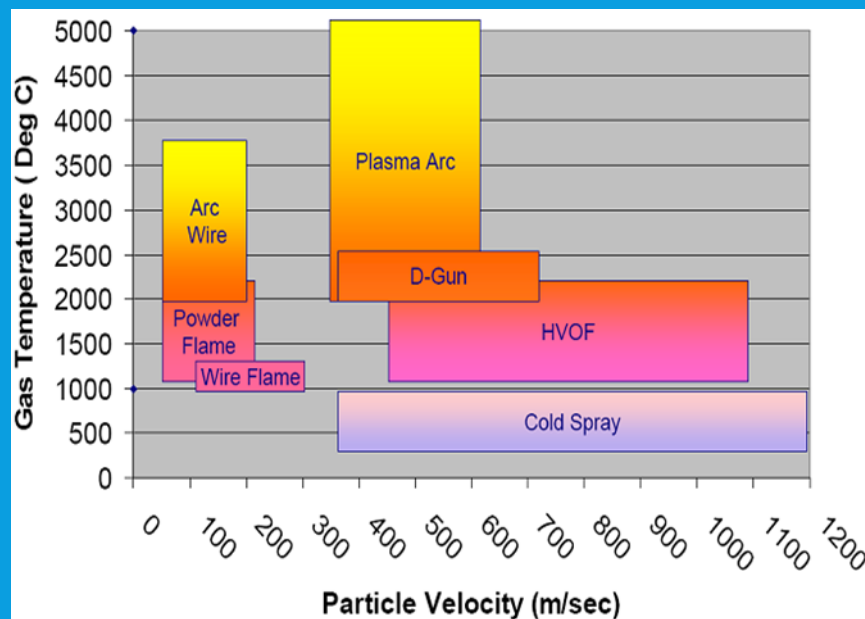
Adhesion | Tensile | Micro Structure Analysis | Hardness | Bond Strength | Abrasion | Corrosion | Sliding Wear | Erosion | Fatigue



High-Pressure Cold Spray unlike thermal spray offers not only dimensional restoration but also structural performance

Benefits of Cold Spray

- No heat affected zone
- Negligible oxidation of cold spray materials
- Spot repairable - ability to reapply onto existing cold spray
- Superior coating adhesion, strength and toughness
- Fully-dense coatings
- Minimal distortion
- Deposition thickness - no limit
- Minimal masking requirements
- Environmentally friendly
- Precise gas temperature control
- Compressive residual stresses



Cold spray operates at much lower temperatures than thermal spray and uses primarily kinetic energy to create solid-state bonded coatings, instead of melting and re-solidification.

VRC

METAL SYSTEMS



Inc. 5000

2017, 2018, 2019, 2020

Certified AS9100D

**Veteran Owned Business of
the Year 2020**

**Large Business of the Year
2022**

**Lockheed Martin Missiles and Fire Control
Exceptional Small Business Award 2023**

**DIMENSIONAL RESTORATION & REPAIR | CORROSION-RESISTANT COATINGS |
WEAR-RESISTANT COATINGS | ADDITIVE MANUFACTURING |
HIGH-STRENGTH DISSIMILAR MATERIAL COATINGS |
FIELD REPAIR | EMI SHIELDING**

Making Metals Work!

Learn more at vrcmetalsystems.com

VRC Sales Dept: sales@vrcmetalsystems.com; +1 605-716-0065

Asia VRC Rep: asia.sales@vrcmetalsystems.com