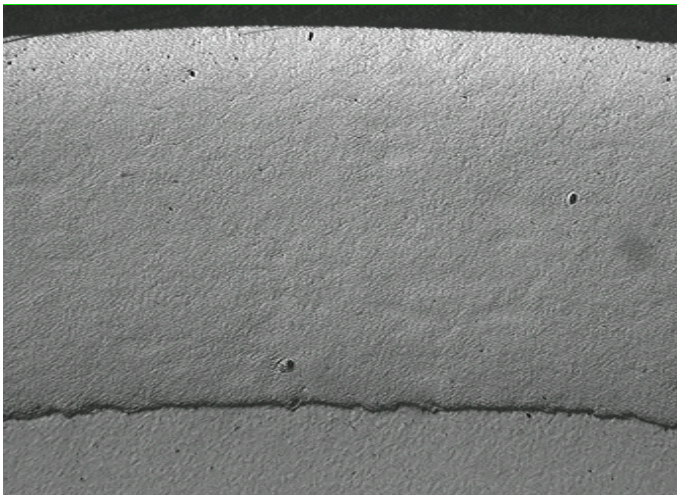
WALLCOLMONOY
SURFACING ALLOYS

WALLCOLMONOY CORP. (USA)
TECHNICAL DATA SHEET



50X Photomicrograph of a fused Colmonoy 62 coating applied to produce a dense, metallurgically bonded coating.

Colmonoy® 62 Alloys:
(62SA, 62SM, 63, 63HV, 62DJ)

Nickel-Based Hard-Surfacing Alloys for Wear, Corrosion, Heat, and Galling Resistance

Description:

Colmonoy 62 alloys include 62SA, 62SM, 63, 63HV and 62DJ. They are atomized nickel-based powder alloys recommended for hardsurfacing new parts to resist wear, corrosion, heat and galling. The alloys are also used for repair of worn or out of tolerance parts. Colmonoy 62 alloys are spray deposited and fused to achieve a hardness range of **Rockwell C 57-63**.

The benefit of this range of alloys is its combined effects of abrasion and corrosion resistance. Colmonoy 62 alloys can be fused by torch, induction, or vacuum and controlled atmosphere furnaces.

Applications include hardsurfacing shafts, sleeves, pump plungers, pump valves, gate valves, sucker rod couplings, bed knives, cams, camshafts, plug gauges, bushings, mill guides, mixer blades, seal rings and conveyor screws.

Colmonoy 62 alloys are not generally used to protect against corrosion alone. The alloys are not resistant to ferric chloride and hot or concentrated nitric acid and should not be used in sodium sulfite liquor or lactic acid (milk products).

Deposits of Colmonoy 62 alloys cannot be cold worked; however, they can be hot formed while in the plastic state during fusion (approximately 1780-1875°F).

Specification Equivalents:

UNS N99646, NACE MR-01-75 and AWS A5.21 Classification ERNiCr-C (applicable to chemistry only).

Nominal Composition - % by Weight:

B	C	Cr	Fe	Si	Ni
3.0	0.6	14.0	4.0	4.2	Bal

Forms Available:

Colmonoy 62 alloys are supplied as atomized powder for application with the Spraywelder™ System, Fusewelder® Torch and other commercially available thermal spray, HVOF and puddle torch systems.

Alloy	Mesh Size	Application
Colmonoy 62SA	140 mesh - 30 µm	Spray-n -Fuse
Colmonoy 62SM	140 mesh - 325 mesh	
Colmonoy 63	140 mesh - 15 µm	
Colmonoy 63HV	230 mesh - 20 µm	HVOF
Colmonoy 62DJ	230 mesh - 15 µm	

Colmonoy 62SA, 62SM, 63:

Colmonoy 62SA, 62SM and 63 are designed for spray and fuse applications, using combustion thermal spray systems such as the J-3 Spraywelder and Fusewelder.

Fused coatings form a metallurgical bond with the substrate providing inter-particle cohesive strength and substrate-to-coating adhesive strength with very low porosity. The coatings show good resistance to wear and impact and their hot hardness is excellent. (Table 3)

Colmonoy 62SM is designed for use with thermal spray systems that are more oxidizing, thereby requiring a coarser material to achieve a quality coating.

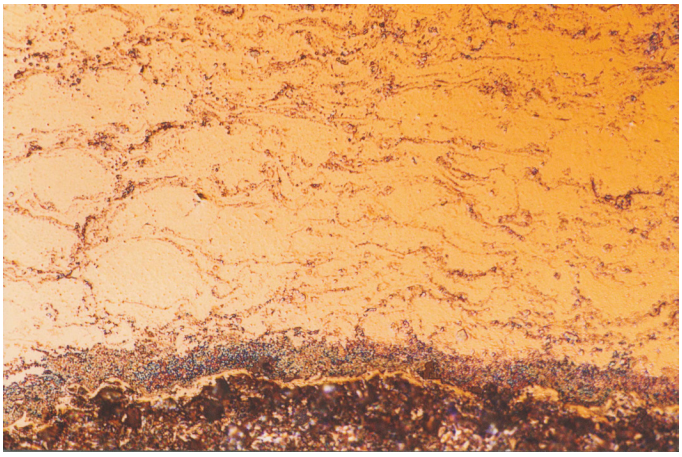
Colmonoy 62DJ and 63HV:

Colmonoy 62DJ and 63HV are designed for use in HVOF Systems and do not require fusing. (Table 4)

Colmonoy 62DJ and 63HV are used for centrifugal pump parts, heat exchanger tubes and other non-point loading applications. The coating is well suited for applications requiring abrasion and corrosion resistance, particularly in the as-sprayed condition when fusing is not possible. The coatings are also used to protect against particle erosion up to 1500°F (815°C).

Colmonoy 62DJ and 63HV cannot be hardened by fusing. A Metallurgical bond can be achieved, and coating integrity can be increased by torch, induction or furnace fusing. The fusing temperature is approximately 1875°F/1025°C.

Coatings of Colmonoy 62DJ and 63HV can be ground with silicon carbide or machined with CBN or carbide tooling.



Photomicrograph (500X) of Colmonoy 63HV

Colmonoy 63HV and 62DJ can be utilized as a chromium plating replacement. Though not as hard (56-62HRC), the coating is more dense (≥98%) and far less prone to cracking.

Properties:

Table 1: Physical Properties (approximate):

Density	0.281 lb/cu in
	7.778 g/cc
Specific Gravity	7.8
Melting Point	1875°F
	1025°C
Specific Heat	0.190 Btu/lb/°F (77-212°F)
	0.7955 kJ/kg/°C (25-100°C)
Thermal Coef. of Expansion	8.1 x 10^{-6} (122-1202°F)
	8.1 x 10^{-6} (50-650°C)
Thermal Conductivity	104 Btu/ft2/hr/in/°F
Coefficiant of Friction (6 - micro surface finish)	0.1
Magnetic Permeability	1.005 N/A^2
Modulus of Elasticity, (Tension or Compression)	32 x 10^6 psi

Table 2: Room Temp. Mechanical Properties:
Deposits produced by Spray-n-Fuse

Compressive strength, (ave.)	300,000 psi
	2,068.43 Mpa
Tensile strength, (ave.)	30,000 psi
	206.84 Mpa
Charpy impact*, (ave.)	1.5 ft-lb
	2.0 N-m
*Specimens having 1/2-inch-radius notch and polished to remove all possibility of stress concentrations	

Table 3: Room & Elevated Temp. Hardness:
Deposits produced by Spray-n-Fuse

Test Temp (°F / °C)	Rockwell C Hardness
70 / 21	57-63
600 / 315	57
800 / 425	54
1000 / 540	49
1200 / 650	45

Application Methods:

Colmonoy 62 alloys are easily applied to all steels having less than .25% carbon, gray cast iron; Meehanite, malleable, ingot and wrought iron; nickel, Monel[a] alloy 400, Inconel[a] alloy 600, Nichrome, Chromel[b]. Most high-temperature alloys can be overlaid without special precautions.

Steel having more than .25% carbon can also be overlaid, but requires controlled slow cooling after fusion, in suitable insulation such as Sil-O-Cel, mica, etc. Do not apply to ferrous metals that require subsequent hardening and tempering, because the dimensional change associated with the formation of martensite will crack the deposits of Colmonoy 62. Hardenable base metals may be overlayed, but must be annealed isothermally after uniform austenitizing to prevent cracking of the deposits of Colmonoy 62. (Consult Technical Services for further details).

Application by Spraywelder:

Colmonoy 62 powder alloys are applied by use of the Spraywelder, which is the recommended Thermal Spray system designed by Wall Colmonoy to produce dense coatings. The powder is sprayed on the part to be hard surfaced as in ordinary metal spraying procedure, and the overlay is then fused to the base metal by torch, induction or furnace. This is ideal when deposits of uniform thickness are being applied over a large area. Reference Spraywelder Brochure and Manual for more information.

Application by Fusewelder:

Colmonoy 63 powder is applied by Fusewelder or similar torch. The Fuseweld Process is a coating application method to apply metallurgically bonded coatings to the edges and corners of molds and blanks. Small shafts, the leading edge of flights for augers and centrifuge scrolls, keyways, splines, and cams can all be efficiently coated or rebuilt with this process.

Application by High Velocity Oxygen Fuel Thermal Spray Processes

Table 4: JP 5000 Parameters for Spraying Colmonoy 63HV*

Gun barrel:	4"
Spray distance:	14"
Coating thickness:	>0.060"
Spray rate:	10-12 lb./hr.

Spray Parameters	Supply Pressure	Flow	System Pressure **
Oxygen	210 psi	1925 scfh	140+/-10 psi
Fuel (K1 kerosene)	170 psi	6.0 gph	121+/-10 psi
Powder (nitrogen carrier)	50 psi	19-20 scfh	not applicable
Combustion	N/A	not applicable	103+/-5 psi
Water Temperature: incoming - outgoing -	70°F 120°+/- 10F		

* Some modifications to the parameters may be needed to compensate for longer hoses.

** System pressures are based on supply pressure and flow settings and are present for the purpose of monitoring the condition system consumables; located at the bottom of the control console.

Table 5: Typical Unfused Coating Characteristics:

Process	JP 5000
Macro Hardness HRC	57-63
Porosity	<2%
Bond Strength	>13,000 psi
Surface Finish (as sprayed) (ground)	240-300Ra <10Ra
Coefficient of Friction (6-micro-inch surface finish)	0.1

Table 6: Hybrid Diamond Jet Parameters with methane (CH_4) for spraying Colmonoy 62DJ*

DJ8-9 Powder Injector
DJ2701 Extended Air Cap (1/4" throat)
9MP-DJ Powder Feeder set at 6.0 lb / hr

Spray Parameters	Pressure (psi)	Flow (SCFH)
Air	110	42
Oxygen	150	30
Fuel	110	68

* Some modifications to the parameters may be needed to compensate for longer hoses.

Machining, Grinding and Lapping:

There are several techniques used for material removal that produce high quality finished products.

Machining can be done, using cubic boron nitride tooling. Use GE's BZN compacts (such as BRNG-43T) or Kennametal's CNMA 433KC-210. Use a negative rake tool, with a 15-degree lead angle. It should have a 3/64-in. radius and T-land edge preparation. Set tool at centerline of work. Feed at 0.005-0.010 IPR, with depth of cut up to 0.125-in., at 200-300 SFM or higher.

The coatings can be machined with difficulty by carbide-tipped tools, such as Kennametal K6, Carboloy 883 or equivalent. For roughing, grind the tool with a slight lead and rake angle, and a slight radius (approx. 1/32"). Use a fine feed, about 0.003" per revolution, with a depth of cut about 0.015" at 15 SFPM. Set tool about 1/32" below center. For finishing, grind the tool with the same slight lead and rake angles and with about a 1/16" radius. Use a fine feed, about 0.003" per revolution, with a maximum cut of 0.005" at approximately 45 SFPM.

Grinding is used after machining to remove the last 0.005-0.006" of material. Actually, the entire finishing is most commonly done by grinding, which eliminates machining. Grinding produces a near-frictionless mirror finish. Such smooth surfaces usually wear better, because they generate less heat and friction. Whereas a diamond wheel is preferred, green silicon carbide wheels (hardness H to K) can be used. Use 24 to 36 grit for roughing and 60 grit or finer for finishing. Grind wet when possible; do not let the wheel get loaded; dress frequently. Take light, fast cuts. (Manufacturer can provide full details for grinding.)

Dry lapping can be used to give the alloy an excellent finish. Silicon carbide, boron carbide and diamond dust are all capable of cutting the Colmonoy coating, but they must be embedded in a cast iron or steel wheel to properly lap fused deposits of Colmonoy 62 alloys. Apply with a steady pressure and avoid overheating. If the lapping compounds are used loose, they will cut the nickel matrix before the chromium carbides, giving the surface an etched appearance.

Safety:

When handling powders do so in such a way to avoid creating a dust cloud; avoid inhalation or contact with skin or eyes. Conduct coating operations in a properly ventilated area. For more information, consult 11.8 (Ventilation), *AWS Thermal Spraying: Practice, Theory, and Application* available from American Welding Society, OSHA Safety and Health Standards available from U.S. Government Printing Office, and the manufacturer's Material Safety Data Sheet (MSDS).

Warning: Sprayweld type torches used for application of this product utilize compressed gases including oxygen and a flammable fuel gas. Follow your employers safety procedures when using and handling these gases and equipment. Infrared and Ultraviolet radiation (light) emitted from flame and hot metal can injure eyes and burn skin. Use appropriate personal protective equipment.

Storage Requirements:

Keep thermal spray powders in a closed container and protect against moisture pick-up. The containers should be tumbled before using the powder. If moisture is absorbed from the atmosphere, it can be removed and flowability can be restored by drying the powder, with the seal removed and lid loosened, at 150-200°F for two hours prior to use.

The information provided herein is given as a guideline to follow. It is the responsibility of the end user to establish the process information most suitable for their specific application(s). Wall Colmonoy Corporation (USA) assumes no responsibility for failure due to misuse or improper application of this product, or for any incidental damages arising out of the use of this material.

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