WALLCOLMONOY
SURFACING ALLOYS

WALLCOLMONOY CORP. (USA)
TECHNICAL DATA SHEET

Fusing Colmonoy® 52 M onto Blow Out Preventer Ram

Colmonoy® 52 M, 52 DJ, 53, 53 HV

Nickel-Based Hard-Surfacing Alloys with Good crack resistance, Good Impact Resistance, and Moderate Hardness

Description:

Colmonoy® 52 & 53 alloys include 52 M, 52 DJ 53, and 53 HV. These alloys are nickel-based powders produced by inert gas atomization. Colmonoy® 52 & 53 alloys can be spray deposited and fused to achieve a dense metallurgically bonded coating layer.

Colmonoy® 52 alloy deposits have moderate hardness, increased ductility, better impact resistance, and less resistance to abrasion compared to Colmonoy® 62 Alloys. These alloys are non-sparking, non-magnetic, non-galling and have low coefficient of friction. They are easily applied to ferrous metals. Colmonoy® 52 & 53 alloys can be fused by torch, induction, or vacuum and controlled atmosphere furnaces. Fusing temperature is approximately 1065°C (1950°F). The alloys are spray deposited and fused to achieve a hardness range of **Rockwell C 45-53**.

Colmonoy® 52 & 53 alloys are used extensively throughout the petroleum industry. Applications include pump shafts, centrifugal pump parts, gates and seats, blow out preventer rams, sleeves and wear rings. Additional applications outside of the petroleum industry are camshaft lobes, glass plungers, cement industry gate and globe valve components, mining crusher shafts, dragline rollers and metalworking dies used for forming and drawing.

Colmonoy® 52 & 53 alloys are not generally used to protect against corrosion alone. The alloys are not resistant to ferric chloride and hot or concentrated hydrochloric acid. Also, they should not be used in sodium sulfite liquor and lactic acid (milk products).

Specification Equivalents:

AWS A5.21 Classification ERNiCr-B (applicable for chemistry only).

Nominal Composition - % by Weight:

B	C	Cr	Fe	Si	Ni
2.4	0.5	13.0	4.0	3.7	Bal

Forms Available:

Colmonoy® 52 & 53 alloys are supplied as atomized powder for application with Wall Colmonoy's Spraywelder™ System, Fusewelder™ Torch and other commercially available thermal spray, HVOF and puddle torch systems.

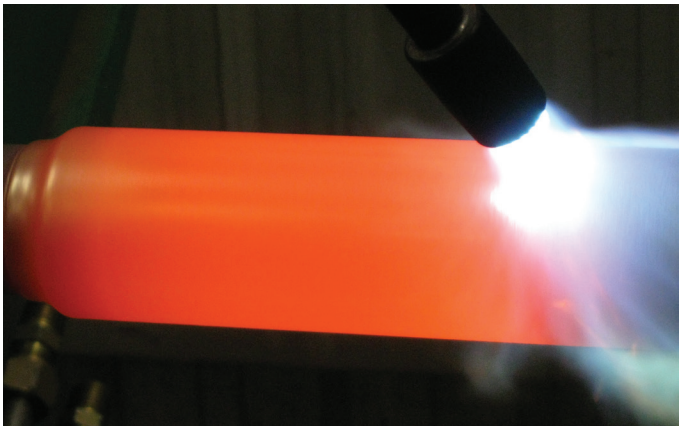
Colmonoy® Alloy	Micron Size	Application
52 M	-125+45 µm	Spray & Fuse
53	-106+20 µm	
52 DJ	-53+5 µm	HVOF
53 HV	-63+20 µm	

Colmonoy® 52 M, 53:

Colmonoy® 52 M and 53 are designed for spray and fuse applications, using combustion thermal spray systems such as the J-3 Spraywelder™ and Fusewelder™.

Colmonoy® 52 M is designed for use with thermal spray systems that are more oxidizing, thereby requiring a coarser material to achieve a quality coating.

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® 52 being fused onto a downhole pump plunger

Colmonoy® 52 DJ and 53 HV:

Colmonoy® 52 DJ and 53 HV are designed for use in HVOF Systems and do not require fusing (tables 4, 5, & 6).

Colmonoy® 52 DJ and 53 HV 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 815°C (1500°F).

Colmonoy® 52 DJ and 53 HV 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 1065°C (1950°F). Coatings of Colmonoy® 52 DJ and 53 HV can be ground with silicon carbide or machined with CBN or carbide tooling. Colmonoy® 53 HV and 52 DJ can be utilized as a chromium plating replacement. Though not as hard, the coating is more dense (≥98%) and far less prone to cracking.

Table 1: Physical Properties (approximate):

Density	7.3 g/cc
	0.26 lb/cu in
Nominal Fusing Temperature	1065°C
	1950°F
Specific Heat	0.46 kJ/kg / °C (25-100°C)
	0.11 Btu/lb / °F (70-212°F)
Thermal Coef. of Expansion	15.1 x 10^{-6} / °C (50-600°C)
	8.4 x 10^{-6} / °F (122-1202°F)
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.)	275,000 psi
	1,896 Mpa
Tensile strength, (ave.)	60,000 psi
	414 Mpa
Charpy impact*, (ave.)	3.0 ft-lb
	4.1 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 & fuse

Test Temp (°C / °F)	Rockwell C Hardness
21 / 70	45-50
315 / 600	46
425 / 800	45
540 / 1000	42
650 / 1200	38

Application Methods:

Colmonoy® 52 & 53 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. Generally, 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® 52. Quenching may be possible. Technical Services should be consulted about your individual situation and needs.

Hardenable base metals may be overlayed, but must be annealed isothermally after uniform austenitizing to prevent cracking of the deposits of Colmonoy® 52 (consult Technical Services for further details).

a Registered trademark of Special Metal Corporation.
b Registered trademark of Concept Alloys.

Application by Spraywelder™:

Colmonoy® 52 SA & 52 M powder alloys can be 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® 53 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. Reference Fusewelder™ Brochure and Manual for more information.

Application by High Velocity Oxygen Fuel (HVOF) Thermal Spray Processes:

Table 4: JP 5000 Parameters for Spraying Colmonoy® 53 HV*

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	N/A
Combustion	N/A	N/A	103+/-5 psi
Water Temperature: incoming - outgoing -	70°F 120°F		

* 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	45-50
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® 52 DJ*

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® 52 & 53 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 Safety Data Sheet (SDS).

Warning: Thermal spray torches and heating torches used for application of this product utilize compressed gasses or liquid fuels including oxygen, air, flammable fuel gas, or flammable liquid fuel. Follow your employer's 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. HVOF and HVAF systems can produce noise levels that can damage hearing. 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 66-93°C (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 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.

updated September 2025