WALLCOLMONOY
SURFACING ALLOYS

WALLCOLMONOY CORP. (USA)
TECHNICAL DATA SHEET

Boat Sleeve - A typical Colmonoy 69 application

Colmonoy® 69 Alloys:
(69SC, 69SM, 69HV)

Nickel-Based Hard-Surfacing Alloys with High Abrasion and Corrosion Resistance

Description:

Colmonoy 69 alloys include 69SC, 69SM, and 69HV. They can be spray deposited and fused to achieve a hardness range of **Rockwell C 58-63**. The alloy's plastic range have been improved to eliminate sagging and running on large, difficult-to-fuse parts.

Colmonoy 69 alloys can be used in a variety of applications, including tail shaft liners of tow boats, pump sleeves, gate valves, bed knives, chipper segments, mixer and rotor blades, etc.

Nominal Composition - % by Weight:

B	C	Cr	Cu	Fe	Mo	Si	Ni
3.5	0.5	16.5	2.0	3.0	3.0	5.1	Bal

Forms Available:

Colmonoy 69 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.

Alloy	Mesh Size	Application
Colmonoy 69SC	140 mesh - 30 µm	Spray-n-Fuse
Colmonoy 69SM	140 mesh - 325 mesh	
Colmonoy 69HV	230 mesh - 20 µm	HVOF

Colmonoy 69SC and 69SM:

Colmonoy 69SC and 69SM are designed for spray and fuse applications, using combustion thermal spray systems such as the J-3 Spraywelder and Fusewelder.

Colmonoy 69SM 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 2)

Colmonoy 69HV:

Colmonoy 69HV is designed for use in HVOF Systems and does not require fusing. (Tables 4 & 5)

Colmonoy 69HV is used for ball valves, 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 69HV 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 1890°F (1030°C).

Coatings of Colmonoy 69HV can be ground with silicon carbide or machined with CBN or carbide tooling.

Colmonoy 69HV can be utilized as a chromium plating replacement. Though not as hard (58-63HRC), the coating is more dense (≥98%) and far less prone to cracking.

Table 1: Physical Properties (approximate):

Density	0.291 lb/cu in
	8.06 g/cc
Furnace Fusing Point	1890°F / 1030°C

Table 2: Room & Elevated Temp. Hardness:
Deposits produced by Spray-n-Fuse

Test Temp (°F / °C)	Rockwell C Hardness
70 / 21	58-63
600 / 315	57
800 / 425	54
1000 / 540	49
1200 / 650	45

Application Methods:

Colmonoy 69 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 69.

Hardenable base metals may be overlayed, but must be annealed isothermally after uniform austenitizing to prevent cracking of the deposits of Colmonoy 69. (Consult Technical Services for further details).

Application by Spraywelder:

Colmonoy 69 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.

Table 3: Recommended Parameters for Applying Colmonoy 69SC and 69SM with 5P and Terodyn 2000

Parameters	5P	Terodyn 2000
Nozzle	P7-G	RL200
Meter Valve	11	Red/Yellow
Spray Rate (lb/hr)	20	18
Flow Control Setting	16-18	16
Oxygen (psi / % flow)	20 / 34	50/30*
Acetylene (psi / % flow)	13 / 34	12/48*
Spray Distance (inches)	8-9	7-9
Airjet @ 30 psi		RPA 3

* FM-1 flowmeter

Application by Fusewelder:

Colmonoy 69 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 69HV*

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	58-63
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

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 69 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: Thermal spray torches and heating 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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