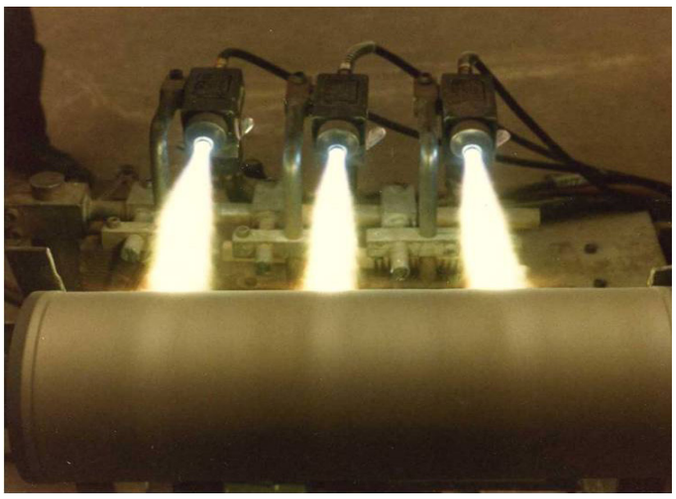
WALLCOLMONOY
SURFACING ALLOYS

WALLCOLMONOY LTD. (UK)
TECHNICAL DATA SHEET



Wallex 50SA applied to a valve stem by three Spraywelder™ Systems

Wallex™ 50 Alloys:
(50SA, 50M, 50H)

A Cobalt-Based Hard-Surfacing Alloy Powder with High Corrosion and Impact Resistance

Description:

Wallex 50 alloys include 50SA, 50M, and 50H. Wallex 50 alloys are self-fluxing cobalt-based hard surfacing alloys with excellent corrosion and abrasion resistance. The alloys have excellent red hardness and superior wetability. They are most suitable for metal-to-metal wear protection in corrosive environments where impact is not substantial. Wallex 50 alloys are non-toxic and non-forgeable. They are spray deposited and fused to achieve a hardness range of **Rockwell C 56-61.**

Like other Wallex cobalt-based alloys, Wallex 50 would not normally be recommended for protection against corrosion alone. The value lies in their ability to protect metal surfaces against a combination of wear-factors, of which corrosion, while perhaps the most prominent, is not the only one. The presence of chromium and tungsten in Wallex 50 makes it almost impervious to common atmospheric conditions.

Wallex 50 has good resistance to solutions of acetic acid, chromic acid, cupric chloride, ferric chloride, ferric sulphate, phosphoric acid and sodium hydroxide at room temperature, and many of these substances at much higher temperatures. Dilute aqueous solutions containing appreciable amounts of chlorine and hypochlorates may slowly produce pitting of the surface, but the cobalt-based Wallex alloy may still be preferred to some austenitic stainless steels because of its superior overall wear resistance.

Nominal Composition - % by Weight:

B	C	Cr	Fe	Ni	Si	W	Co
3.7	0.8	19.0	2.5	18.0	2.8	10.0	Bal

Forms Available:

Wallex 50 alloys are supplied as atomised powder for application with Wall Colmonoy's Spraywelder™ System, Fusewelder® Torch and other commercially available thermal spray and HVOF systems.

Alloy	Mesh Size	Application
Wallex 50SA	106µm - 38µm 140mesh - 500mesh	Spray-n-Fuse
Wallex 50M	125µm - 45µm 120mesh - 325mesh	
Wallex 50H	63µm - 20µm 230mesh - 625mesh	HVOF

Wallex 50SA and 50M:

Wallex 50 is 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).

Wallex 50 is designed for use with thermal spray systems that are more oxidising, thereby requiring a coarser material to achieve a quality coating.

Wallex 50H:

Wallex 50H is designed for use in HVOF Systems and does not require fusing. (Table 4)

Wallex 50H 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 1095°C (2000°F).

Coatings of Wallex 50H can be ground with silicon carbide or machined with CBN or carbide tooling.

Wallex 50H can be utilised as a chromium plating replacement. Though not as hard (56-61HRC), the coating is more dense (≥98%) and far less prone to cracking.

Properties:

Table 1: Physical Properties (approximate):

Specific Gravity	8.5
Melting Point	1120°C (2050°F)

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

Compressive strength, (ave.)	2,068.43 MPa
	300,000 psi
Tensile strength, (ave.)	206.84 MPa
	30,000 psi
Charpy impact*, (ave.)	2.0 N-m
	1.5 ft-lb
*Specimens having 12.7mm (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 (°C / °F)	Rockwell C Hardness
21 / 70	56-61
315 / 600	56
425 / 800	56
540 / 1000	56
650 / 1200	49

Application Methods:

Wallex 50 alloys are easily applied to all steels having less than .25% carbon, grey 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 Wallex 50. Hardenable base metals may be overlayed, but must be annealed isothermally after uniform austenitising to prevent cracking of the deposits of Wallex 50. (Consult Technical Services for further details).

Application by Spraywelder:

Wallex 50 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 High Velocity Oxygen Fuel Thermal Spray Processes

Table 4: JP 5000 / 8000 Parameters for Spraying Wallex 50H*

Gun barrel: 102mm (4")
Spray distance: 365mm (14")
Coating thickness: >1.5mm (>0.060")
Spray rate: 4.5-5.4kg/hr (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 -	21°C 50°C+/- 5°C		

* 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.

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 1.2Mmm (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 3.18mm (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. 0.79mm (1/32")). Use a fine feed, about 0.075mm (0.003") per revolution, with a depth of cut about 0.38mm (0.015") at 15 SFPM. Set tool about 0.79mm (1/32") below centre. For finishing, grind the tool with the same slight lead and rake angles and with about a 1.16mm (1/16") radius. Use a fine feed, about 0.076mm (0.003") per revolution, with a maximum cut of 0.13mm (0.005") at approximately 45 SFPM.

Grinding is used after machining to remove the last 0.13-0.15mm (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 Wallex coating, but they must be embedded in a cast iron or steel wheel to properly lap fused deposits of Wallex 50 alloys. Apply with a steady pressure and avoid overheating. If the lapping compounds are used loose, they will cut the cobalt 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 utilise 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 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 Limited (UK) 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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