WALLCOLMONOY
SURFACING ALLOYS

WALLCOLMONOY CORP. (USA)
TECHNICAL DATA SHEET

Wallex™ 40 Alloys:
(40, 40HV, 40PTA)

Valve Seat - A Typical Application of Wallex 40

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

Description:

Wallex 40 Alloys include 40, 40HV, and 40PTA. The alloys are self-fluxing cobalt-based hard surfacing alloys with high corrosion and impact resistance. They are softer than Wallex 50, therefore giving it better impact resistance. The alloys have excellent red hardness and superior wetability. They are a good hard surfacing choice in situations where the hazard of chemical or atmosheric corrosion is accompanied by metal-to-metal wear and/or impact. Wallex 40 alloys are non-toxic and non-forgeable. They are spray deposited and fused to achieve a hardness range of **Rockwell C 41-46.**

Like other Wallex cobalt-based alloys, Wallex 40 alloys would not normally be recommended for protection against corrosion alone. Their 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 40 make it almost impervious to common atmospheric conditions.

Wallex 40 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
2.0	0.6	16.2	2.0	23.5	1.9	7.6	Bal

Forms Available:

Wallex 40 alloys are supplied as atomized powder for application with the Spraywelder™ System, Fusewelder® Torch and other commercially available thermal spray, HVOF and PTA systems.

Alloy	Mesh Size	Application
Wallex 40	140 mesh - 500 mesh	Spray-n-Fuse
Wallex 40HV	230 mesh - 635 mesh	HVOF
Wallex 40PTA	100 mesh - 325 mesh	PTA

Wallex 40:

Wallex 40 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 2)

Wallex 40HV:

Wallex 40HV is designed for use in HVOF Systems and do not require fusing. (Table 3)

Wallex 40HV 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 2080°F (1045°C).

Coatings of Wallex 40HV can be ground with silicon carbide or machined with CBN or carbide tooling.

Properties:

Table 1: Physical Properties (approximate):

Specific Gravity	8.9
Melting Point	2080°F (1140°C)
Thermal Coef. of Expansion	7.4 x 10^{-6} (122-1202°F)
	7.4 x 10^{-6} (50-650°C)

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

Test Temp (°F / °C)	Rockwell C Hardness
70 / 21	41-46
600 / 315	38
800 / 425	36
1000 / 540	30
1200 / 650	25

Application Methods:

Wallex 40 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 Wallex 40. Hardenable base metals may be overlayed, but must be annealed isothermally after uniform austenitizing to prevent cracking of the deposits of Wallex 40. (Consult Technical Services for further details).

Application by Spraywelder:

Wallex 40 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 3: JP 5000 Parameters for Spraying Wallex 40HV*

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 4: Typical Unfused Coating Characteristics:

Process	JP 5000
Macro Hardness HRC	41-46
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

Application by PTA Welding:

There are numerous Plasma Transferred Arc Welding systems on the market and a wide range of welding parameters can be used with Wallex 40PTA to produce excellent weld overlays.

Wall Colmonoy recommends that a pure argon plasma gas be used in combination with an argon-hydrogen shielding gas and an argon carrier gas.

Welding parameter settings will depend on the base metal, its thickness, geometry and metallurgical condition as well as the desired properties/geometry of the weld overlay and the type of PTA equipment being used.

Preheat and weld inter-pass temperature can affect the quality of the weld deposit and its wear properties.

Preheat Temperature by Class for steels

Class	Description	up to ½"	½" to 1"	1" to 2"	Interpass
10xx	C steels	100 – 600	100 – 700	100 – 800	200 – 700
13xx	Mn steels	350 – 500	400 – 600	450 – 700	450 – 600
23xx	Ni steels	200 – 400	200 – 500	300 – 700	300 – 600
31xx	Ni – Cr steels	200 – 600	300 – 700	400 – 900	>400
32xx	Ni – Cr steels	300 – 900	400 – 1000	500 – 1100	500 – 900
33xx	Ni – Cr steels	500 – 900	600 – 1000	700 – 1100	700 – 900
34xx	Ni – Cr steels	900 – 1100	900 – 1100	900 – 1100	900 – 1100
4140	Cr – Mo steel	600	700	800	600 – 800
4340		600	800	900	700 – 900
46xx		400 – 600	500 – 700	600 – 800	≅ 600
4820		600	700	800	600 – 800
5120		100 min	200 – 300	250 – 350	≅ 300
5145		400 – 500	450 – 550	500 – 600	≅ 500
86xx		100 – 400	200 – 500	300 – 600	≅ 400
High strength alloy steels (quenched and tempered)					
A533, B		50 – 200	100 – 350	200 – 450	100 – 350
A542		150 – 300	200 – 350	250 – 450	200 – 350
HY-130		75 – 225	75 – 275	200 – 375	200 – 350

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 Wallex coating, but they must be embedded in a cast iron or steel wheel to properly lap fused deposits of Wallex 40 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 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.

Danger: Plasma transferred arc (PTA) welding is a welding process used for application of this product. Follow your employers safety procedures and the equipment manufacturers instructions when PTA welding. Electric shock can kill. Properly install and ground electrical equipment prior to use. Infrared and ultraviolet radiation emitted from the hot metal or welding arc 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 (66-93°C) 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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