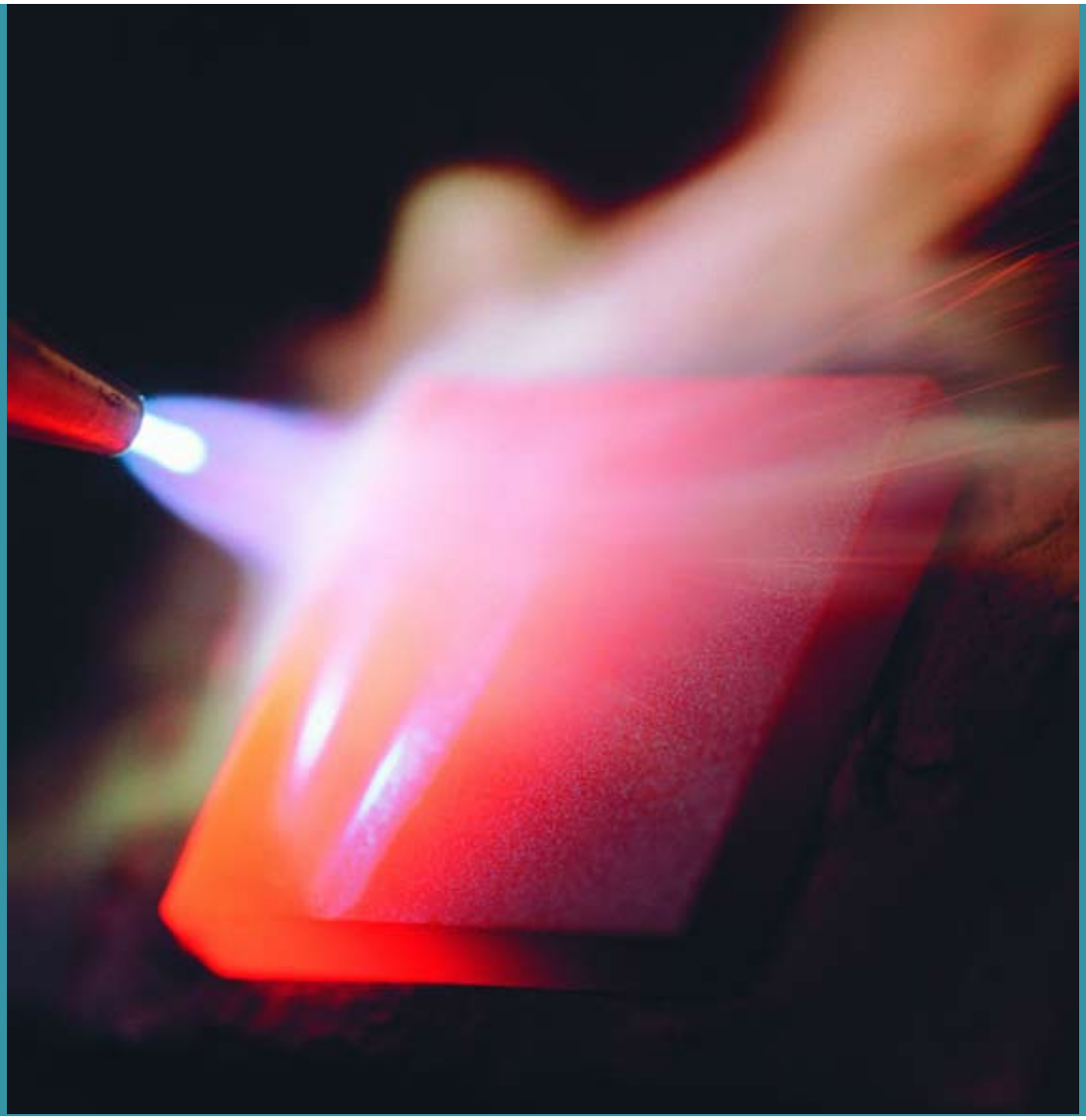
Höganäs



Thermal Surfacing
Powder choice with ease

Why Thermal Surfacing

Thermal surfacing is a cost effective method to achieve high performance characteristics on exposed metallic surfaces.
A metal object can be surface coated on the exposed area to achieve high wear and corrosion resistance.
Thermal surfacing can also be used to repair damaged parts. Complete part replacement is then unnecessary and this refurbishment effectively extends the operating life.

Thermal surfacing techniques are today standard practice for many applications in a wide range of industries:

- Agriculture
- Automotive
- Chemical
- Energy production
- Glass mould
- Heavy motorised equipment
- Marine
- Paper
- Petrochemical
- Plastic extrusion
- Repair and replacement
- Steel manufacture

The common denominator for all of these applications is the need to achieve wear, corrosion, heat, abrasion or impact resistance. This combination of properties needs a balanced metal powder formulation as it is application specific.
Our atomised powders are particularly suited to the needs of thermal surfacing techniques such as powder welding, flame spraying, plasma spraying, HVOF (high velocity oxy-fuel), PTA (plasma transferred arc), laser cladding and cold spraying.

Extending the application range

Höganäs AB is an independent powder manufacturer providing a full range of surface coating products. A comprehensive choice of high quality nickel, cobalt and iron based powder solutions enhances the potential for thermal surfacing industry applications. Continuous development aims at extending properties and application techniques to drive new solutions and expand the application range.

Unique advantages of Höganäs powder

Spherical satellite free particles are a unique characteristic from Höganäs AB for all powder solutions on offer to the thermal surfacing industry. This provides the key to optimum solutions when morphology is combined with the correct alloy system and particle size distribution.
Customer benefits:

- Excellent powder feed flow
- Less moisture sensitivity
- Higher deposition rate
- Lower porosity
- Lower gas consumption (as exemplified on page 4)

Environmental Commitment

We believe that environmental commitment is as important as product operating capability. Höganäs AB's products provide energy and environmentally efficient solutions for our customers. Our production processes are characterised by their efficient use of energy natural resources and by minimum generation of waste. Environmental and energy-related objectives and action plans use the ISO 14001 environmental management standard as a tool within the group's production facilities. Rational and fully recyclable packaging minimises transportation costs and environmental impact.

Quality

Höganäs AB's quality assurance program fulfils the requirements of ISO 9001 and TS 16949. This ensures our customers have a consistent product quality over time. Actively achieving ever tighter control of process parameters by using statistical process control (SPC).
Customer benefits of SPC on applications:

- Consistent powder quality minimizes customer equipment adjustment time.
- Consistency between lots transforms equipment adjustment time to production time.
- Every lot produced is test coated with appropriate equipment before release.

Comprehensive Technical Support

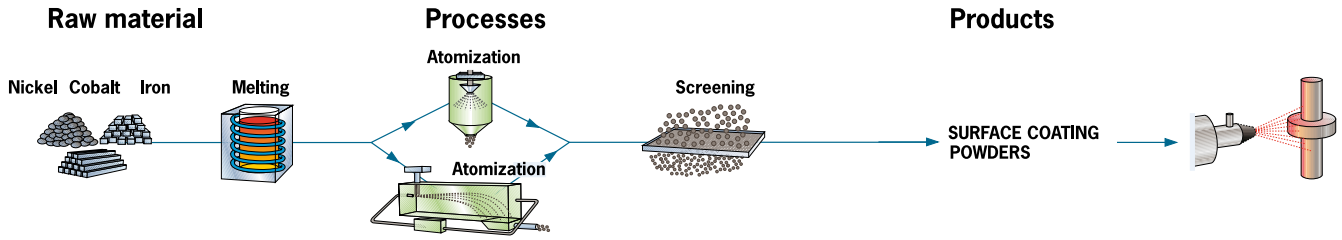
Partners enjoy full support from our laboratory facilities. Customer service investigations are well served by our application equipment laboratory with flame spray, powder welding, PTA and laser cladding. The scientific data required is generated in our metallographic laboratories. Competent personnel execute and interpret results in order to generate solutions for specific customer problems.

Knowledge and Partnership

Our metal powder developments aim to actively stimulate growth in the thermal surfacing industry. Knowledge is the corner stone of success and the metallurgical expertise of Höganäs AB is central to our powder development. The focus for metal powder success is the extensive production resources that anticipate and respond to market needs. Our established reputation as a reliable supplier of thermal surfacing powders is a strong foundation for partnership.

Advanced products

Höganäs AB is a dedicated supplier of powder with manufacturing excellence. The atomisation processes employed at our facilities produce powders that pass stringent controls at each step of the process.
The final confirmation of quality is spray deposition in our applications laboratory, to ensure the best results for you. An extensive range of powders is available, fractioned according to a wide range of particle size intervals, as recommended by various spray equipment manufacturers.



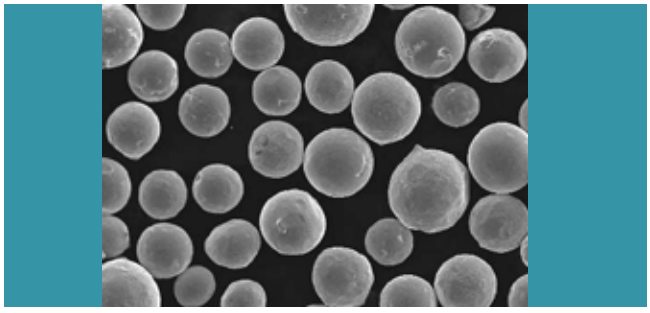
The requirements of your application will determine the type of powder to be used, and the process required.

The signature for high quality finished surfaces

In order to achieve the highest quality thermal surfacing finish Höganäs AB's high grade powder feed is recommended. A surface that is smooth with lower porosity and clean finish requires less polishing efforts. A high deposition rate can increase productivity and volume through put. A uniform bonding of the applied metal surface to the base ensures fewer defective parts. Consistent equipment parameters after lot change, reduces equipment adjustment time. These are the characteristics that were born in mind when developing our powder offering to the thermal surfacing industry.

Unique advantages of Höganäs powder

Our powders combine optimum morphology with a wide range of alloy systems and particle size distribution. Spherical particles without satellites is the characteristic morphology for Höganäs AB. When applied this results in higher deposition rates, lower porosity and uniform bonding. The lower oxygen content of our powders also contributes to a cleaner surface finish.
A spherical powder flow requires less gas to transport the same quantity of powder.
In the case of powder welding a lower gas pressure is required for spherical particles. Lower gas pressure



means less gas is consumed during the coating process. In the case of PTA welding it is possible to quantify this and gas consumption reductions of up to 25% have been observed.
Spherical particle geometry has the lowest surface area to volume ratio of any shape. This means that it absorbs less moisture than any other shape. Absorbed moisture on the powder surface is thus less of a concern.
As an independent manufacturer we offer a powder range suitable for all equipment. ISO certified production units ensure that the chemical and physical properties follow the specification. This secures the science but the final confirmation of the reality is in the surfacing. Every lot produced is test coated with appropriate equipment before release to the customer.

Metal Powders for Thermal Surfacing

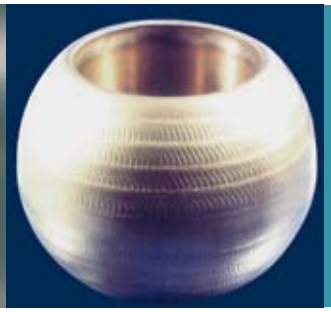
The preferred line of defense against corrosion, wear and fast thermal cycling in moulds, neck rings and plates for the glass bottle-making industry.

Efficiently applied high wear resistant surface on bottle plunger and neck rings.

Boiler tubes district heating station can withstand temperature cycling, corrosive environments and fluctuating particulate levels.

Extremely hard wolfram carbide surfacing keeps cutter blades sharp in the paper industry.

Reduce wear and corrosion on valves.



Protect ball valves in the petrochemical industry against corrosion and mechanical wear.

HVOF spraying of rollers for printing.

Steel rollers gain durability, accuracy and efficiency in production.

Powder and process match performance

The range of surfacing equipment techniques and metal powders in use has grown in pace with the growth of the thermal surfacing industry. We produce a full range of nickel-, iron- and cobalt-based atomised powders. These grades are developed for the specific needs of a given thermal surfacing equipment and application. The surfacing techniques that our powders serve include:

Powder welding

employs a standard oxy-acetylene torch, with the powder fed into the flame from an attached hopper. Typically used for glass moulds, smaller parts and repairs. Particularly suitable for the repair of cast iron and machined parts. Powder welding gives a smooth, dense coating with diffusion bond to the base material. Deposition rates are from 0.5–2.5 kg/hour, and surfacing thickness from 0.2–12 mm.

Flame spraying,
where powder is fed into a fixed oxy-acetylene or oxy-hydrogen flame, and projected towards the base material. The semi-molten material forms a mechanical bond which, when fused to the work piece, creates a metallurgical bond. Flame spraying is ideal for coating cylindrical parts. High-hardness alloys and tungsten carbide mixtures can be used with advantage. Deposition rates are from 1–9 kg/hour, and surfacing thickness from 0.1–3 mm.

Plasma spraying
employs a technique essentially similar to flame spraying. It differs in that the flame comprises an electrically excited plasma of high velocity and temperature (≈15,000°K). This permits a denser coating (95-98%). Deposition rates are from 2–8 kg/hour, and surfacing thickness from 0.1–2.5 mm.

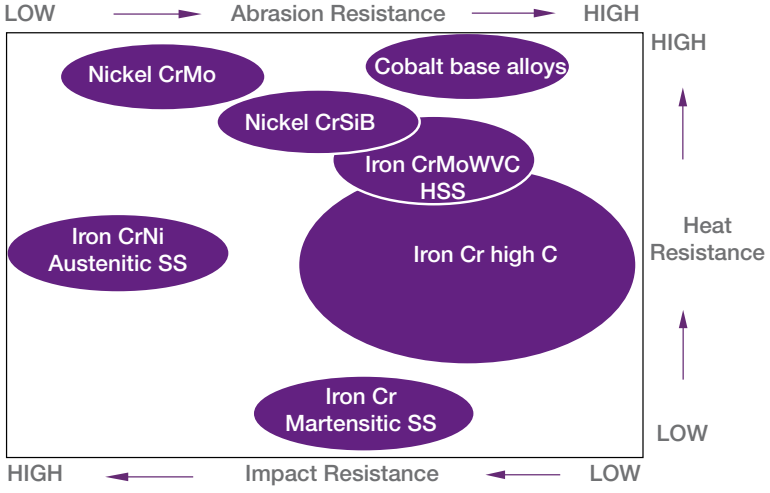
HVOF (High-Velocity Oxy-Fuel) spraying
combines velocities up to 700 m/s with moderate temperatures. This process provides a very dense coating (> 97%). Deposition rates are up to 9 kg/hour, and surfacing thickness from 0.05–2.5 mm.

PTA (Plasma Transferred Arc) welding
is a process which can be highly automated. It utilises a combined arc/plasma stream to form a limited melt on the work piece surface. A low base metal dilution with a small heat affected zone and a dense uniform coating is achieved. A wide range of user-specific consumables are possible. This process has found extensive use in high-volume automated applications such as the thermal surfacing of exhaust valves. Deposition rates up to 12 kg/hour are possible, and surfacing thickness from 1– 6 mm.

Laser cladding
focuses and controls heat and weld depth, offering a clean metallic bond with minimal dilution, a small heat affected zone and fine grain structure. Deposition rates are up to 8.0 kg/hour, and surfacing thickness from 0.5 to more than 4 mm.

How to choose the right powder

Factors to consider
Chemical composition and porosity determines the abrasion, heat, impact and corrosion resistance of the thermal surface.
Particle size distribution can affect weld shape and is often equipment specific. These are the main factors used to determine the right powder for a specific application.
This diagram and the tables on the following pages, will help you to focus your search.
The hardness of the deposit is strongly dependent on spray performance.



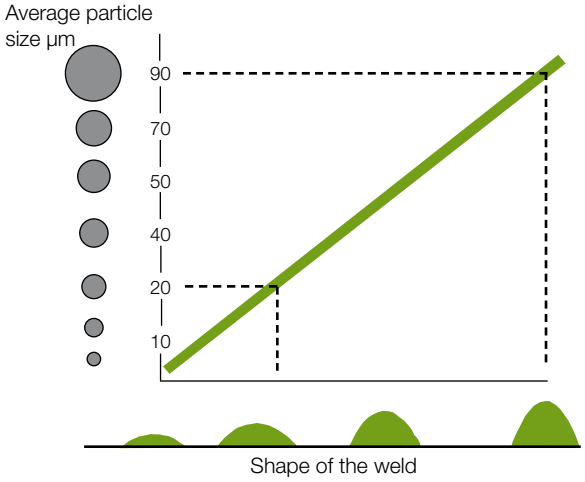
Powder welding grades

Nickel-base	Particle size µm	C %	Si %	B %	Fe %	Cr %	Ni %	Mo %	Others %	Hardness HRC	Hardness HV_{30}	Recommended use/Features/Comments
1015-00	20-106	0.03	2.0	1.1	0.5	–	Bal.	–	Cu=20.0	15*	210**	Repair of cast iron, e.g. engine blocks.
1020-00	20-106	0.03	2.4	1.4	0.4	–	Bal.	–	–	20*	230**	Welding on new cast iron surfaces. Repair of machining errors. Repair of engine blocks, bearings, threads, wing pumps and press tools.
1021-10	20-106	0.03	2.0	0.65	0.3	3.0	Bal.	–	P=2.0	21*	250**	Improved fluidity, lower melting point.
1623-05	10-53	0.04	2.5	1.6	0.4	–	Bal.	–	–	23*	270**	Easy to machine. Can be filed by hand.
1025-40	20-106	0.05	2.7	1.8	0.4	–	Bal.	–	–	28*	295**	
1031-10	20-106	0.03	2.2	0.9	0.3	3.0	Bal.	–	P=2.2	28*	290**	Improved fluidity, lower melting point.
1035-40 1135-40	20-106 20-71	0.32	3.7	1.2	3.0	7.0	Bal.	–	–	35*	360**	Repair and build-up of small plungers and neck rings in the glass bottle manufacturing industry.
1036-40	20-106	0.15	2.8	1.2	0.4	4.5	Bal.	2.5	P=1.9	36*	375**	Improved fluidity, lower melting point.
1040-00	20-106	0.25	3.5	1.6	2.5	7.5	Bal.	–	–	40*	425**	Repair and build-up of worn parts for moulds, valves, bearings, splines, seal rings, valve gates, water pumps and sprockets.
1045-00	20-106	0.35	3.7	1.8	2.6	8.9	Bal.	–	–	47**	500**	Good fluidity.
1050-00	20-106	0.45	3.9	2.3	2.9	11.0	Bal.	–	–	52**	580**	All applications with high demand on wear and corrosion resistance, e.g. rocker arms, bearings, diesel engine valves, crusher rolls, conveyor screws, fan blades, textile spindles, pistons, pump shafts, agricultural arms and mixer blades.
1060-00	20-106	0.75	4.3	3.1	3.7	14.8	Bal.	–	–	62**	810**	Further improvement of wear resistance can be obtained by mixing with carbides.

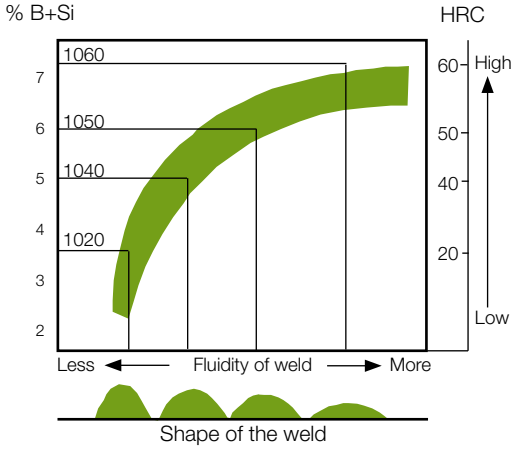
* Indicative value
** Measured value

Recommended use
Features
Comments

Powder welding - particle size effect on weld shape



Effect of B+Si on fluidity and hardness



Flame spraying grades

Nickel-base	Particle size µm	C %	Si %	B %	Fe %	Cr %	Ni %	Mo %	Others %	Hardness HRC	Hardness HV_{30}	Recommended use/Features/Comments
1240-00 1340-00	36-106 45-125	0.25	3.5	1.6	2.5	7.5	Bal.	–	–	38*	380**	Build-up of layers on plungers in the glass bottle manufacturing industry where good machinability is required. Also for bearings, piston heads, shafts in rolling mills, fan blades, valve gates, pump sleeves and pump rotors.
1245-00 1345-00	36-106 45-125	0.35	3.7	1.8	2.6	8.9	Bal.	–	–	44**	450**	
1250-00 1350-00	36-106 45-125	0.45	3.9	2.3	2.9	11.0	Bal.	–	–	51**	570**	Bearings, diesel engine valves, rocker arms, valve seats, rolls for rolling mills, pump shafts, pump sleeves, seal rings, piston rods, steam valves, screw conveyors, moulds for bricks and ceramics, mixer blades, chip knives, etc.
1355-20	45-125	0.55	4.0	3.4	2.7	16.0	Bal.	3.0	Cu=3.0	57**	700**	
1260-00 1360-00	36-106 45-125	0.75	4.3	3.1	3.7	14.8	Bal.	–	–	61**	790**	Further improvements can be achieved by mixing with tungsten carbides. See also carbide powder grades.
1360-20	45-125	0.90	4.3	3.3	4.2	16.3	Bal.	–	–	62**	820**	

* Indicative value
** Measured value

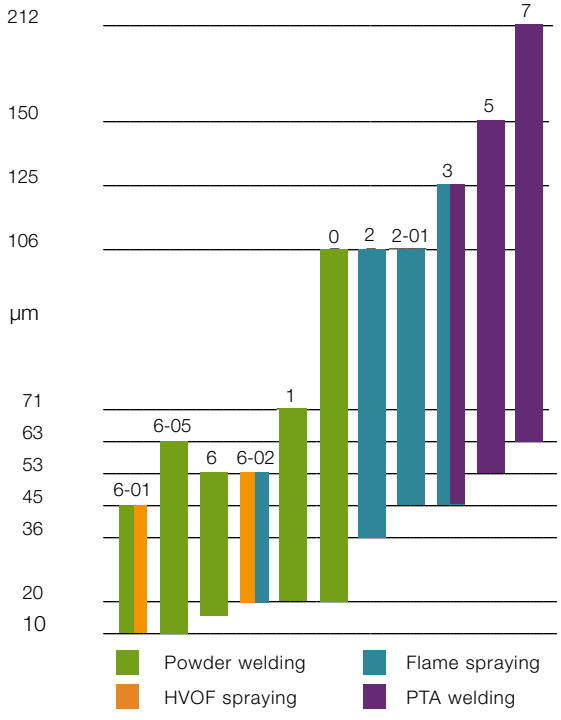
Recommended use
Features
Comments

Recommended settings

Torch	Oxygen Bar	Oxygen Flow	Acetylene Bar	Acetylene Flow	Powder Flow	Air Bar	Air Flow	Particle size µm
Metco 5P/6P	1,7	34	1,0	34	17			45 - 125
Terodyn 2000		35		48				36 - 106 45 - 106
Castodyn 8000	4		0,7					36 - 106 45 - 106
Colmonoy J	2,0	50	1,0	30		1,7	55	36 - 106 45 - 106
Uni Spray Jet	4		0,5			0	0,5	36 - 106 45 - 106

Flame spraying is a two-step process which results in a dense coating and a metallurgical bond. The process can employ high-hardness alloys, and even mixtures containing tungsten carbide. The technique can be easily automated and adapted to the spraying of cylindrical parts.

Particle size range



Plasma and HVOF spraying grades

Nickel-base	Particle size µm	C %	Si %	B %	Fe %	Cr %	Ni %	Mo %	Others %	Hardness HRC	Hardness HV_{30}	Recommended use/Features/Comments
625	20-53	≤ 0.03	0.4	–	0.75	21.5	Bal.	9.0	Nb=3.6		200**	IN 625 [1]
C276-m	20-53	0.12	0.5	–	3.0	15.5	Bal.	16.0	W=3.8 Co=2.0		260**	C 276 [1]
1616-02	20-53	0.20	1.0	–	0.5	20.0	Bal.	–	Mn=0.75		280*	Bond coat for ceramic coatings.
1660-02	20-53	0.75	4.3	3.1	3.7	14.8	Bal.	–	–		780*	Alloys for coating steam or gas turbine blades or other applications requiring extremely dense plasma coatings.
1660-22	20-53	0.90	4.3	3.3	4.2	16.3	Bal.	–	–		820**	The layer can be rendered completely dense by heat.

Cobalt-base	Particle size µm	C %	Si %	Fe %	Cr %	Ni %	Co %	Mo %	W %	Hardness HRC	Hardness HV_{30}	Recommended use/Features/Comments	
2628-02	20-53	0.25	0.9	1.5	27.0	2.5	Bal.	5.5	–		300**	Stellite 21 [2]	Cobalt base for corrosion and oxidation resistance. Better hot hardness values than for equivalent nickel base.
2637-02	20-53	1.1	1.0	1.5	28.5	1.5	Bal.	–	4.4		380*	Stellite 6 [2]	
2641-02	20-53	1.4	1.1	1.0	28.5	1.5	Bal.	–	8.0		420*	Stellite 12 [2]	
HB400	15-45	≤ 0.05	2.7	0.5	9.0	0.5	Bal.	29.5	–		500**	Triballoy 400 [2]	

Iron-base	Particle size µm	C %	Si %	Fe %	Cr %	Ni %	Mo %	Mn %	Others %	Hardness HRC	Hardness HV_{30}	Recommended use/Features/Comments
316L	20-53	≤ 0.03	0.8	Bal.	17.0	12.0	2.5	1.5	–		160**	316L [3]
410L	20-53	≤ 0.03	0.5	Bal.	12.5	–	–	0.1			220*	410L [3]
3650-02	20-53	1.75	1.3	Bal.	28.0	16.0	4.5	0.8	–		500**	

* Indicative value
** Measured value

Recommended use
Features
Comments

Photo coutesy of Praxair

HVOF is the surfacing method of choice when extremely high-density coatings are required. The process is easily automated and very little subsequent machining is required.

Characteristics	Flame spraying	HVOF spraying	Plasma spraying
Gas temperature (°C)	3000	2600-3000	12000-16000
Spray rate (kg/h)	1-9	1-9	2-8
Particle velocity (M/s)	>50	>700	>450
Bond strength (MPa)	7-83 + fused	48-80	14-48
Coating thickness (mm)	0,1-3	0.05-2.5	0.1-2,5
Hardness (HRC)	20-60	20-60	20-60
Porosity (%) cold spray	10-15	>3	2-5
Porosity (%) fused	~1-2	<3	~1-2

PTA and Laser cladding grades

Nickel-base	Particle size µm	C %	Si %	B %	Fe %	Cr %	Ni % Base	Mo %	Others %	Hardness HRC	Hardness HV_{30}	Recommended use/Features/Comments
1535-30	53-150	0.25	3.0	1.0	2.4	5.6	Bal.	–	Al=1.0	32*	310**	For surfacing on cast iron and bronze.
1540-00	53-150	0.25	3.5	1.6	2.5	7.5	Bal.	–	–	40**	425*	For surfacing on cast iron and bronze. Nickel base for medium-to-hard welds, e.g. for diesel engine valves and various types of seals.
1550-00	53-150	0.45	3.9	2.3	2.9	11.0	Bal.	–	–	52**	580*	
1560-00	53-150	0.75	4.3	3.1	3.7	14.8	Bal.	–	–	62**	810*	
1559-40	53-150	≤0.06	3.0	2.9	0.2	–	Bal.	–	–	49**		Suitable for wear resistant coatings.
1759-40	63-212											Contains WC.
625	53-150	≤0.03	0.40	–	1.4	21.5	Bal.	9.0	Nb=3.8		200**	IN 625 [1]
C276-m	53-150	0.12	0.5	–	3.0	15.5	Bal.	16.0	W=3.8 Co=2.0		210**	C276 [1]

Cobalt-base	Particle size µm	C %	Si %	Fe %	Cr %	Ni %	Co % Base	Mo %	W %	Hardness HRC	Hardness HV_{30}	Recommended use/Features/Comments
2528-00	53-150	0.25	1.0	1.5	27.0	2.8	Bal.	5.5	–		340**	Stellite 21 [2]
2537-00	53-150	1.1	1.0	1.5	28.5	1.5	Bal.	–	4.4	41**		Stellite 6 [2]
2737-00	63-212											Stellite 6 [2]
2537-10	53-150	1.3	1.0	1.5	28.5	1.5	Bal.	–	4.4	43**		Stellite 6 [2]
2737-10	63-212											Stellite 6 [2]
2540-00	53-150	1.7	1.2	1.2	25.7	22.8	Bal.	–	12.5	42**		Stellite F [2]
2741-00	63-212	1.4	1.1	1.0	28.5	1.5	Bal.	–	8.0	44**		Stellite 12 [2]
2748-00	63-212	2.4	1.1	–	30.0	–	Bal.	–	12.5	56**		Stellite 1 [2]
HB 400	53-150	≤0.05	2.7	0.5	9.0	0.5	Bal.	29.5	–	53**		Triballoy 400 [2]

Cobalt base for corrosion and oxidation resistance. Better hot hardness values than for equivalent nickel base.

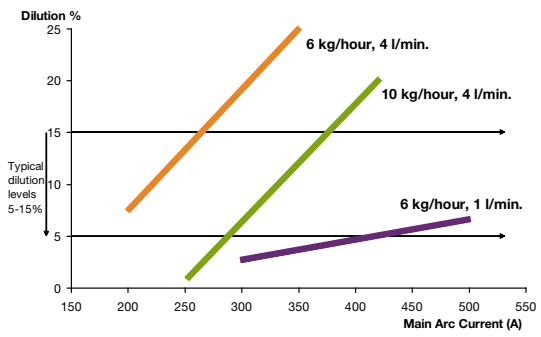
Iron-base	Particle size µm	C %	Si %	Fe % Base	Cr %	Ni %	Mo %	Mn %	Others %	Hardness HRC	Hardness HV_{30}	Recommended use/Features/Comments
3533-00	53-150	1.75	1.3	Bal.	28.0	16.0	4.5	0.8	–	33**		
3733-00	63-212											
3533-10	53-150	2.1	1.2	Bal.	28.0	11.5	5.5	1.0	–	42**		
316L	53-150	≤0.03	0.8	Bal.	17.0	12.0	2.5	1.5	–		160**	316L [3] stainless steel.
410L	53-150	≤0.03	0.5	Bal.	12.5	–	–	0.1	–		220**	410L [3]
M2	53-150	1.0	0.3	Bal.	4.0	–	5.0	0.3	V=2.0 W=6.2	63**		Abrasive-wear resistant.

All grades can be ordered with sieve 53–150 µm, 63-212 µm and 45-125 µm.

Recommended use
Features
Comments

* Indicative value
** Measured value for PTA, higher with laser

Plasma Transferred Arc (PTA) surfacing is ideal for high unit volume automated applications, such as thermal surfacing of exhaust valves. Low base metal dilution and a wide range of consumables are two of several advantages that the technique can offer.



Carbide powder grades

Tungsten-base	Particle size µm 106-36	C %	Co %	W %	Recommended use
4370 4070 4670	45-125 36-106 20-53	4.0	–	Bal.	Melted W_2C/WC. To be mixed with self-fluxing powders 1060 or 1660 to provide wear resistance coatings.
4580	53-150	6.1		Bal.	Macro Crystalline tungsten carbide (WC). Primarily to be mixed with Ni-based self-fluxing alloys to provide wear resistant coatings with improved thermal stability.
44712-10 [4] 46712-10 [4] 46712-11 [4]	53-106 20-53 10-53 [5]	5.5	12.0	Bal.	Agglomerated powder WC-Co.To be mixed with flame-spraying powders. Spherical particles give more uniform distribution of carbide in the matrix. Also for plasma spraying and HVOF.
PA 2 PA 2	45-106 -45	5,7	7,5	Bal.	Angular shape.To be mixed with Ni-based self-fluxing alloys. Suitable for HVOF.

Special products and packing

Höganäs AB has product development in many application areas. Our metal powder expertise and extensive production capabilities allow us to offer a wide range of powders suited to specific thermal surfacing applications. Höganäs also supplies self-fluxing powders and carbide powders ready-mixed to users' specifications. When potential volume is viable, customised products are focused in partnership with the end user.

Packaging

Thermal surfacing powders are packed in 5 kg plastic bottles. The packing technique ensures a uniform grain size distribution. Transportation may cause some segregation, and therefore it is recommended to thoroughly mix the powders before use. When requested, powders are also available in 25-kg metal pails.
All packaging materials can be recycled.

Powder designations
1 6 20 – 1 1
A B C – D E
A: Alloy Base
1 = Nickel
2 = Cobalt
3 = Iron
4 = Tungsten Carbide
B: Standard Particle Size Range
0 = 20 – 106 µm
1 = 20 – 71 µm
2 = 36 – 106 µm
3 = 45 – 125 µm
5 = 53 – 150 µm
6 = 15 – 53 µm
7 = 63 – 212 µm
C: Average Hardness:
Rockwell C
D: Chemical Composition
1–9 = modified
E: Particle Size Range
1–9 = modified

Foot notes
[1] Registered trademark Inco Corp.
[2] Registered trademark Deloro Stellite
[3] A.I.S.I. standard
[4] Spherical particles
[5] This sieve is especially designed for HVOF

The Power of Powder

Metal powder offers entirely new possibilities to create more effective, lighter products with a reduced environmental impact. By combining the right alloy with a suitable morphology of the powder grains, new opportunities open up to match your challenges. Contact us and together we will release the power.

Metal powders are traditionally used to manufacture sintered components for vehicles. But there is a lot more to them. By fortifying food with elemental iron, anaemia can be reduced. By coating with nickel, glass bottle production life is prolonged with wear and temperature resistance. By employing new iron based powders, high temperature brazing of heat exchangers is possible. By utilising the three dimensional magnetic flux of encapsulated metal powders, smaller electrical motors can now be produced. And so on.

In fact, the possibilities of metal powder technology are almost endless. To take advantage of the inherent Power of Powder, please contact your nearest Höganäs office.

Sweden Höganäs AB
Höganäs
Phone +46 42 33 80 00
Fax +46 42 33 81 50

Brazil Höganäs Brasil Ltda
Mogi das Cruzes
Phone +55 11 4736 7711
Fax +55 11 4736 7734

China Höganäs (China) Ltd
Shanghai
Phone +86 21 692 101 12
Fax +86 21 692 131 94

France Höganäs France S.A.
Villefranche-sur-Saône Cedex
Phone +33 474 02 97 50
Fax +33 474 60 63 61

Germany Höganäs GmbH
Düsseldorf
Phone +49 211 99 17 80
Fax +49 211 991 78 35

India Höganäs India Ltd
Pune
Phone +91 20 66 03 01 71
Fax +91 20 26 13 01 88

Italy Höganäs Italia S.r.l.
Rapallo (Genoa)
Phone +39 0185 23 00 33
Fax +39 0185 27 04 77

Japan Höganäs Japan K.K.
Tokyo
Phone +81 3 3582 8280
Fax +81 3 3584 9087

Rep. of Korea Höganäs Korea Ltd
Seoul
Phone +82 2 511 43 44
Fax +82 2 548 25 92

Spain Höganäs Ibérica S.A.
Madrid
Phone +34 91 708 05 95
Fax +34 91 708 05 94

Taiwan Höganäs Taiwan Ltd
Taipei
Phone +886 2 2543 1618
Fax +886 2 2543 1511

United Kingdom Höganäs (Great Britain) Ltd
Tonbridge, Kent
Phone +44 1732 377 726
Fax +44 1732 770 262

United States North American Höganäs, Inc.
Hollsopple: PA
Phone +1 81 4479 3500
Fax +1 81 4479 2003

www.hoganas.com
www.hoganasthermalspray.com