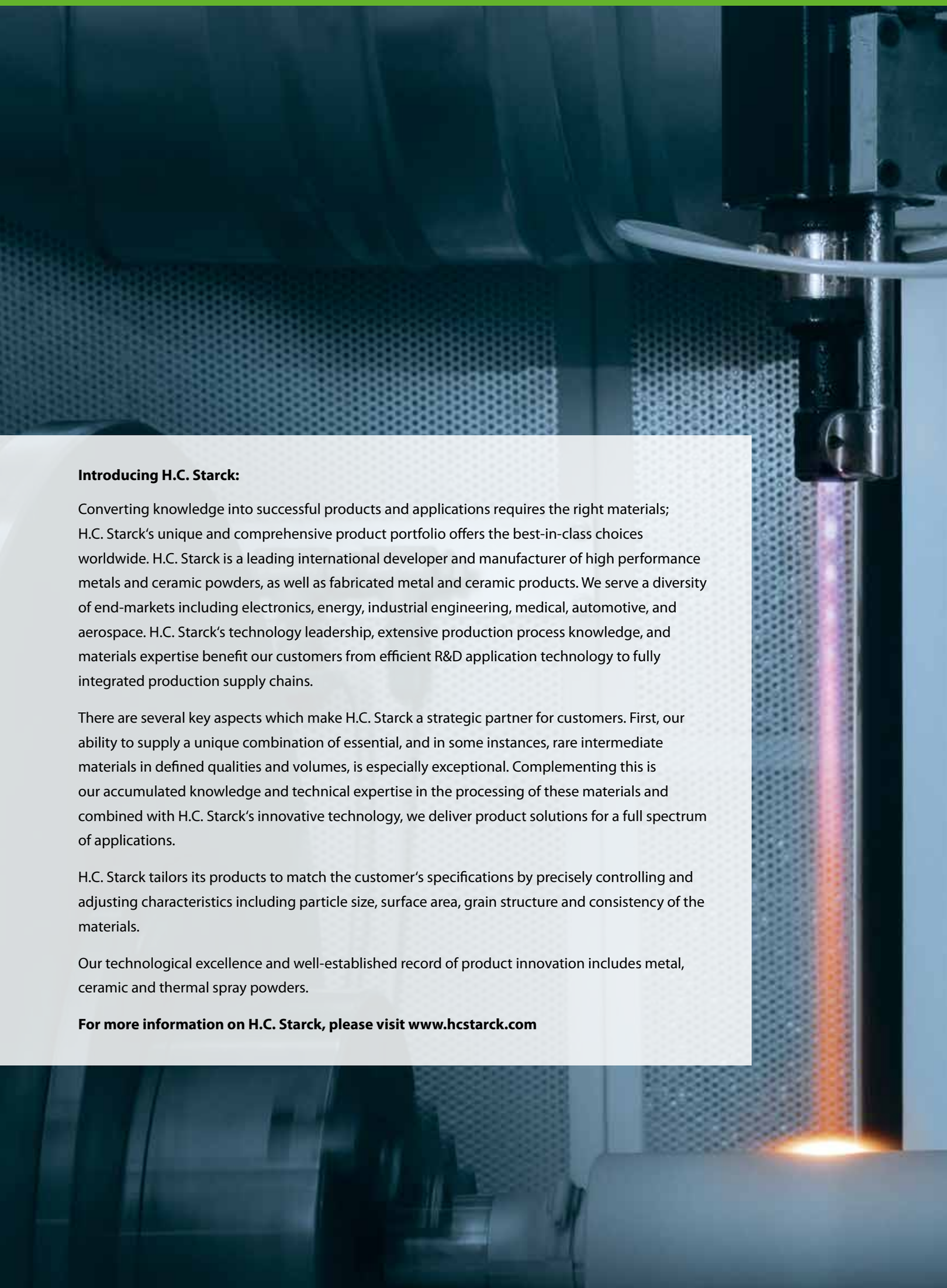
Technology Metals | Advanced Ceramics

AMPERIT®

Thermal Spray Powders

H.C.Starck



Introducing H.C. Starck:

Converting knowledge into successful products and applications requires the right materials; H.C. Starck's unique and comprehensive product portfolio offers the best-in-class choices worldwide. H.C. Starck is a leading international developer and manufacturer of high performance metals and ceramic powders, as well as fabricated metal and ceramic products. We serve a diversity of end-markets including electronics, energy, industrial engineering, medical, automotive, and aerospace. H.C. Starck's technology leadership, extensive production process knowledge, and materials expertise benefit our customers from efficient R&D application technology to fully integrated production supply chains.

There are several key aspects which make H.C. Starck a strategic partner for customers. First, our ability to supply a unique combination of essential, and in some instances, rare intermediate materials in defined qualities and volumes, is especially exceptional. Complementing this is our accumulated knowledge and technical expertise in the processing of these materials and combined with H.C. Starck's innovative technology, we deliver product solutions for a full spectrum of applications.

H.C. Starck tailors its products to match the customer's specifications by precisely controlling and adjusting characteristics including particle size, surface area, grain structure and consistency of the materials.

Our technological excellence and well-established record of product innovation includes metal, ceramic and thermal spray powders.

For more information on H.C. Starck, please visit www.hcstarck.com

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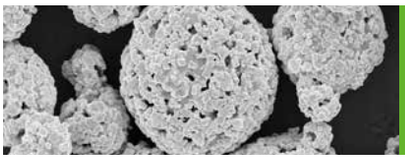

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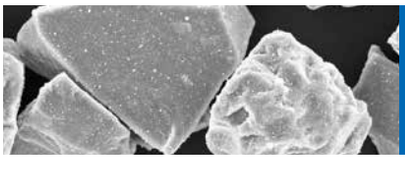

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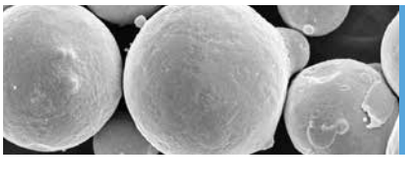

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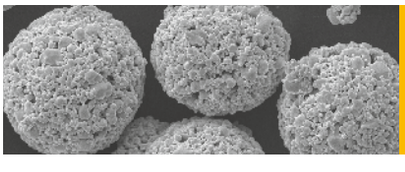

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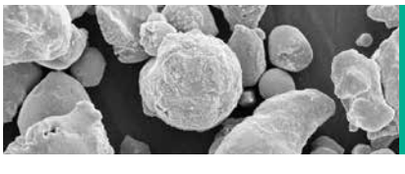

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| ADDED VALUE |

High Quality Partnership

AMPERIT® powders for thermal spraying are prime examples of the high standards we set for our products. In order to meet customers' requirements in coating and coating processes, we pay particular attention to the specific requirements of controlled chemistry, precisely defined grain forms and morphologies, and adjusted particle size distribution. Our brand ***AMPERIT®*** is known for reliable high quality and over forty years experience in the thermal spray market. Our two main manufacturing facilities for thermal spray powders located in Laufenburg and Goslar, Germany, offer a wide variety of production methods, which include fusing, crushing, sintering, agglomerating, blending, coating, gas and water atomization and plasma spheroidization.

With a secure raw material supply chain and overspray recycling, we are able to deliver thermal spray powders with constant high quality and on a regular basis.

Our proximity to our customers' requirements and applications guides our business. Decades of experience have given us an understanding of how to develop new materials and recycling processes, and how to improve the products we provide to our customers. Comprehensive application engineering offers a unique advantage for ***AMPERIT®*** products, ranging from powder development to complete coating solutions. H.C. Starck's experts provide customers with technical assistance and support, and a wealth of knowledge in materials and coating technology.

Our product portfolio covers the markets' needs for all major applications in Thermal Spraying:

- **Carbides for wear and corrosion protection**
- **Oxides for wear, chemical and heat protection**
- **MCrAlYs for bond coats, corrosion and oxiddation protection in high temperature applications**
- **Molybdenum for industrial and automotive applications**
- **Other pure metals and alloys**

Our products are tailored for specific processes, such as products dedicated for HVAF and HVOF coatings.

Application Engineering and Product Customization

H.C. Starck's modern thermal spray and specialized metallographic laboratories represent top-quality application engineering. Modern, small-sized production facilities for agglomeration and sintering, and the latest atomization technology allow us to produce materials according to our customer's request.

A pilot spray laboratory tests and optimizes products for customers and develops processing recommendations from the testing results. The plant is equipped with coating units for all major spraying processes. Corrosion, wear and cavitation tests assist in developing and completing coating solutions for various applications.

Spraying equipment includes:

- **HVOF (JP-5000, DJ Hybrid)**
- **Plasma (F4, 3/7/9 MB)**
- **Cold spray (Kinetiks 4000)**
- **Additional equipment (e.g. HVAF) is available on request**

Tests include:

- **Corrosion tests (Salt Spray ASTM B117, Electrochemical Corrosion)**
- **Cavitation test**
- **Bond Strength test**
- **Surface roughness test**
- **Wear test (ASTM G65 method B, Pin on Disk, JIS H8503)**
- **Hardness tests (Micro-, Macrohardness)**

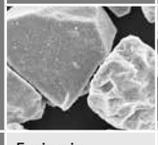
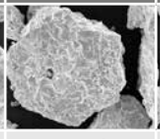
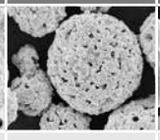
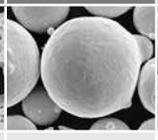
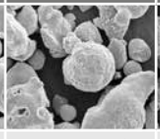
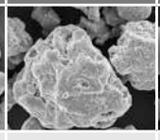
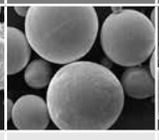
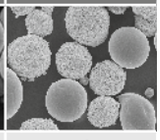
Standard powders are modified or new powders are designed in small production units. The ability to modify standard powders ensures fast and economic customization along with prompt testing on a smaller-scale basis. Innovative materials closely geared to market needs are also developed to offer unique solutions to meet even the most challenging requirements.

Small scale production equipment includes:

- **Small spray dryers**
- **Small sintering furnaces**
- **Mixing, milling and classification equipment**
- **Small atomizer (for metal and alloys)**

Our Portfolio: Unique in Scope and Depth

We offer a unique selection of high-quality materials and material combinations which are precise and reliable in quality.

POWDER TYPE	Fused and crushed	Sintered and crushed	Agglomerated and sintered	Gas atomized	Water atomized	Dense coated	Spheroidized	Blended
								
PROCESS	Fusing in arc furnaces, followed by cooling and crushing	Sintering of raw materials, crushing	Spray drying of a suspension consisting of fine powders and organic binder and subsequent sintering	Atomizing molten metal or alloy with high pressure gas (Ar, N_2) stream into a chamber	Atomizing with water into a chamber and subsequent drying	Reduction of a metal salt solution	Feeding of agglomerates using a plasma flame to produce spherical shaped particles	Mixing of 2 or more powders
CHARACTE-RISTICS	Blocky, irregular, dense	Blocky, irregular, relatively dense	Spherical, porous, constituents homogenously distributed	Spherical, dense, high purity, low oxygen content	Irregular, dense, increased oxygen content compared to gas atomized	Blocky or irregular composite	Spherical, porous or hollow, partly open (shells)	Different morphologies, segregation possible
EXAMPLES	Al_2O_3; Cr_2O_3; ZrO_2-Y_2O_3	WC-Co; WC-CoCr	WC-Co Cr; Cr_3C_2-NiCr; ZrO_2-Y_2O_3	MCrAlY; Ni-, Co-base alloys; NiAl	NiCr; NiAl	Ni-Graphite	ZrO_2-Y_2O_3	NiSF + WC-Co; Mo + NiSF; Cr_3C_2-NiCr

For more information regarding our product solutions, please visit www.hcstarck.com, where you can find our detailed **Technical Bulletins** and discover more about ***AMPERIT***®.

| PROFOUND EXPERTISE |

Examples of Applications

Customer-specific product solutions from H.C. Starck's unique product range are becoming increasingly indispensable for innovative applications and new markets.

Gas Turbines for Aircraft and Power Generation

High temperature corrosion and oxidation resistance for turbine blades through sprayed MCrAlY alloys; thermal barrier coatings made of ZrO_2-Y_2O_3 for turbine parts in the highest temperature zones; wear resistant coatings made of WC-Co, Cr_3C_2-NiCr; and abradable seals made of soft Ni-graphite for rotating parts are only some application examples of high quality ***AMPERIT®*** powders in the very demanding turbine environment.

Automotive

Driven by the growing demand for safe, reliable, and fuel saving vehicles, the automotive industry develops and employs new processes and materials. Thermal spray powders can help reduce friction between piston rings and cylinder bores. Excellent examples are H.C. Starck's Mo + NiSF powders for piston rings, which reduce wear and friction in combustion engines.

Pulp and Paper / Printing

Wear resistance is required across the entire range of pulp and paper production, and is complicated by corrosion. H.C. Starck's ceramic or carbide wear-resistant coatings for paper machine cylinders and laser engravable Cr_2O_3 coatings for printing rolls meet all necessary requirements of this industry.

Oil & Gas

High standards for wear, erosion, abrasion, and corrosion resistance are the main reasons why H.C. Starck's tungsten carbides, metals and alloys are highly used in the oil and gas industry. Our products make it possible for applications such as mud pump rotors, ball and gate valves, plungers, and piston rods to cope with extreme conditions such as high pressure from water and sub-sea environments as well as permanent NaCl exposure.

| SUSTAINABILITY |

Overspray Recycling

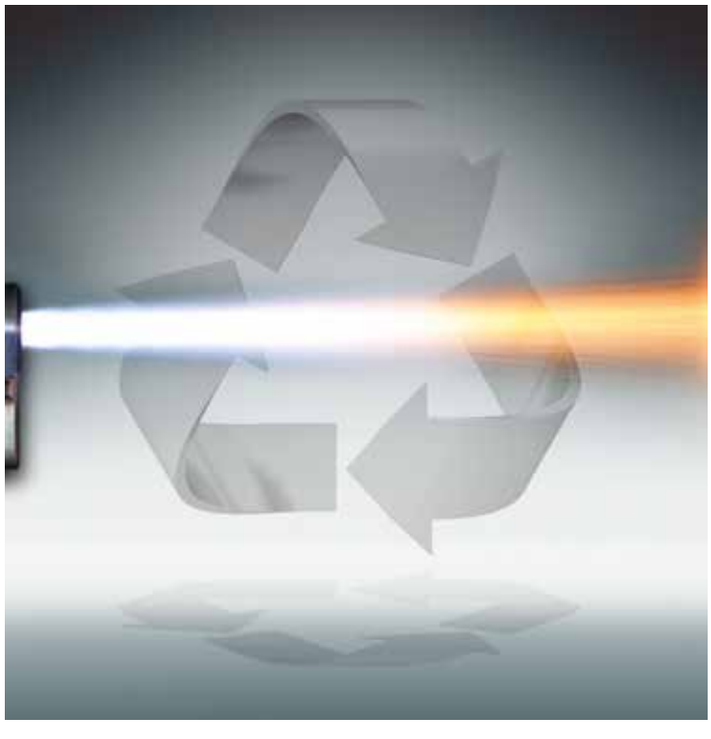
Two Challenges ...

> Raw Material Efficiency: For technical reasons, thermal spraying is associated with a relatively high volume of overspray.

> Disposal: The recent regulatory requirements dictated by the thermal spraying industry regarding the handling and disposal of materials, scrap, and by-products have become stricter due to REACH* regulation.

... One Solution!

> H.C. Starck's Overspray Recycling enhances the raw material efficiency in thermal spraying as it returns the overspray into its own tungsten and rhenium production. Here it is reprocessed into raw materials for our high-quality ***AMPERIT***® products. Collection, transportation and treatment are fully in line with legal provisions, contributing to the safe disposal of overspray.

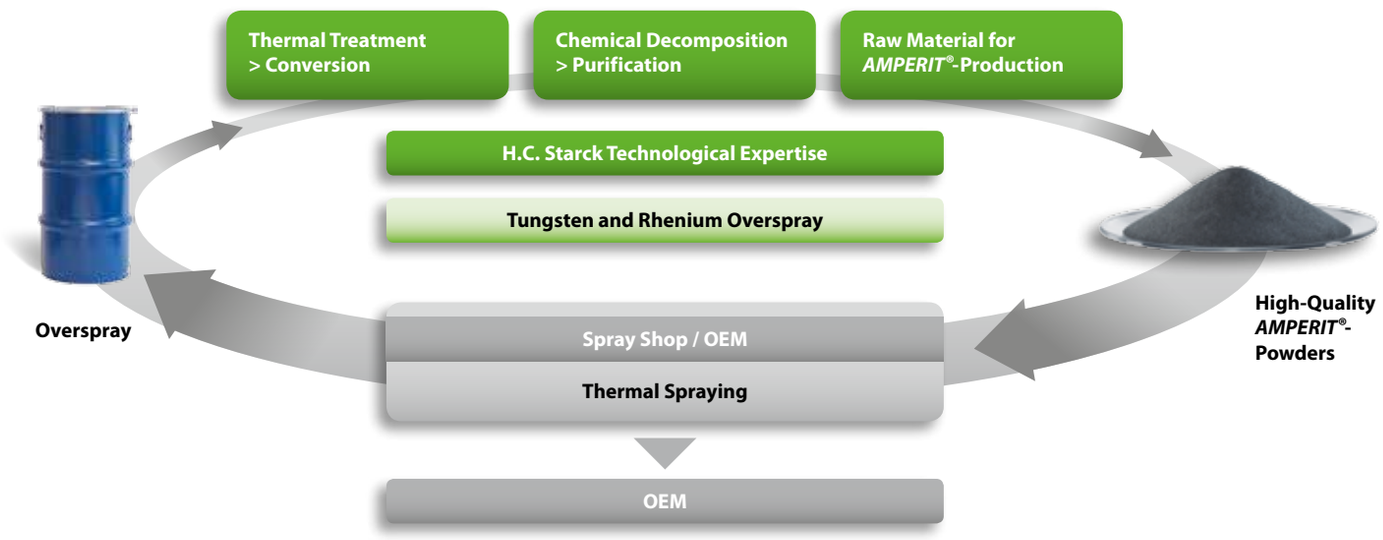


* REACH is a European Community Regulation (EC) 1907/2006 by the EU Parliament and Council from December 18, 2006, concerning the registration, evaluation, authorization and restriction of chemicals. It aims to regulate and control potential hazards and risks for human health and the environment associated with the production, import and use of chemicals within the European Union. The REACH regulation targets are important guidelines for H.C. Starck.

Closed Loop: Sustainable Raw Material Usage Without Loss of Quality

H.C. Starck's Closed Loop:
Sustainable Raw Material Usage Without Loss of Quality

The closed loop overspray recycling process is an integrated cycle that ensures a sustainable raw material usage.
The chemical conversion of the overspray and its reprocessing in H.C. Starck's own tungsten and rhenium production, eliminates any impact of the recycling process on our excellent product quality. In this way, we contribute to stabilizing the raw material supply and preserving our natural resources.



Our Closed Loop ensures both Highest Quality & Environmental Responsibility

H.C. Starck provides its customers all necessary support to handle overspray materials in sustainable way and in conformity with legal requirements. Through cost-efficient, fast material analysis and value assessment, support in handling and transportation, as well as efficient processes with its own W and Re production, H.C. Starck offers an economical, sustainable and highly competitive overspray recycling service to its customers.

We take on Responsibility

New Green Carbides for Improved Occupational Health & Safety

Cobalt containing carbide powders, such as WC-Co and WC-Co-Cr, have been developed with varying chemistries, carbide sizes, and production methods. These powders are widely used for wear, erosion, and corrosion protection in many industrial fields. However, for decades it has been well-known in the hard metal industry that hard metals containing WC and Co in breathable dust form can provoke severe lung diseases, if inhaled.

With our ***AMPERIT*® 618** we have created a WC-based product with a Cobalt- (Co) and Nickel- (Ni) free matrix, which in contact with air and humidity produces no aggressive or harmful oxygen radicals. Moreover, it has excellent corrosion and erosion, as well as abrasion and cavitation, resistance. Our environmental-friendly ***AMPERIT*® 618** meets all the requirements for WC-based spray powders, and reduces health and environmental hazards at the same time.

***AMPERIT*® 618** has been specially developed for the deposition by HVOF systems. The density and the wear resistance of the coatings are comparable to WC-Co 88/12.

In aqueous NaCl based media both corrosion resistance and emissions of metal matrix ions of ***AMPERIT*® 618** are superior to WC-Co-Cr 86/10/4.

In addition to our ***AMPERIT*®** thermal spray powders, we also offer a broad range of atomized metal powders under the brand name ***AMPERSINT*®** for various technologies, like Additive Manufacturing, Hot Isostatic Pressing, Press & Sintering, Metal Injection Molding as well as special powder solutions for welding applications (PTA, Laser Cladding) under brand name ***AMPERWELD*®**.

Contact us to learn more about our powder capabilities.

AMPERIT® | CARBIDES

for wear protection

AMPERIT® CARBIDES — for wear protection

AMPERIT®	Grain Size in µm or Specification	Chemistry / Powder Type	Typical Properties and Applications
NEW **507.025**	HVAF	WC-Co-Cr[1-6] 86/10/4 Agglomerated and sintered	• HVOF, HVAF • Nanometric WC • For nano structured coatings with superior surface finish • For applications in paper and foil industry
NEW **507.074**	45/15		
NEW **507.059**	30/5		
512.059	30/5	WC-Co[1-6] 88/12 (Low Carbon) Agglomerated and sintered	• HVOF • Coarse WC • C: 3.6 - 4.1% • Spherical • Used for Zn bath rolls in Continuous Galvanizing Lines (CGL)
512.074	45/15		
515.001	45/22	WC-Co[1-6] 88/12 Sintered and crushed	• APS • Very coarse WC • C: 3.9 - 4.3% • Hard, dense coatings with good abrasion, erosion and sliding wear resistance • Used for machine parts, etc.
515.002	90/45		
515.074	45/15		
515.203	MTS 1055		
515.400	AMS 7879		
515.401	PWA 1302 [1-4][7]		
515.830	BMS 10-67 Type 1		
515.851	PM 819-1 + PM 819-53		
515.949	DMS 2049 Type 2		
518.001	45/22	WC-Co[1-6] 88/12 Agglomerated and sintered	• HVOF, APS, HVAF • Medium WC • Max. operating temperature 500 °C • Hard, dense coatings with good abrasion, erosion and sliding wear resistance • Smooth coatings with fine microstructure and high bond strengths • Low oxidation and corrosion resistance • Used for general wear, paper rolls, wire drawing equipment, fan and compressor blades, pump seals and housing, machine parts, etc.
518.002	90/45		
518.025	HVAF		
518.054	45/10		
518.059	30/5		
518.074	45/15		
518.088	53/20		
518.280	GE B50TF27 Cl.A		
518.768	GE B50TF27 Cl.B		
518.874	PM 819-25		
519.025	HVAF	WC-Co[1-6] 88/12 Agglomerated and sintered	• HVOF, HVAF • Fine WC • Higher apparent density • Designed for kerosene guns • See ***AMPERIT***® 518
519.059	30/5		
519.074	45/15		
519.088	53/20		
526.059	30/5	WC-Co[1-6] 83/17 Agglomerated and sintered	• HVOF, APS • Coarse WC • Max. operating temperature 500 °C • Higher ductility than WC-Co 88/12 due to higher Co content • Hard, dense coatings with low sliding wear and high impact resistance • Protection against fretting and abrasion • Low oxidation and corrosion resistance • Used in aviation applications (fan and compressor blades, mid-span stiffeners, flap tracks, etc.), extrusion dies, glass industry, paper mill rolls, pump parts, wire drawing equipment, etc.
526.062	53/10		
526.074	45/15		
526.077	63/32		
526.223	MTS 1058		
526.350	MSRR 9507/1		
526.382	MSRR 9507/69		

AMPERIT® | CARBIDES

for wear protection

AMPERIT® CARBIDES — for wear protection

AMPERIT®	Grain Size in µm or Specification	Chemistry / Powder Type	Typical Properties and Applications
526.454	PWA 36331-1	WC-Co[1 - 6] 83/17 Agglomerated and sintered	• HVOF, APS • Coarse WC • Max. operating temperature 500 °C • Higher ductility than WC-Co 88/12 due to higher Co content • Hard, dense coatings with low sliding wear and high impact resistance • Protection against fretting and abrasion • Low oxidation and corrosion resistance • Used in aviation applications (fan and compressor blades, mid-span stiffeners, flap tracks, etc.), extrusion dies, glass industry, paper mill rolls, pump parts, wire drawing equipment, etc.
526.727	DMR 33-501		
526.729	DMR 33-019		
526.781	DHMS C4.19	WC-Co[1 - 6] 83/17 Agglomerated and sintered	• HVOF, APS • Coarse WC • Max. operating temperature 500 °C • Higher ductility than WC-Co 88/12 due to higher Co content • Hard, dense coatings with low sliding wear and high impact resistance • Protection against fretting and abrasion • Low oxidation and corrosion resistance • Used in turbine applications (mid-span stiffeners, fan blades, flap tracks, etc.), extrusion dies, glass industry, paper mill rolls, pump parts, wire drawing equipment, etc.
526.831	BMS 10-67 Type 1		
526.895	DMS 2049 Type 5		
528.764	GE B50TF295 Cl.A	WC-Co[1 - 6] Agglomerated and sintered	• See ***AMPERIT***® 518
529.072	38/10	WC-NiMoCrFeCo[2, 7, 9, 10] 82/18 Agglomerated and sintered	• HVOF • Medium WC • Alternative to WC-CoCr • For very dense and ductile coatings with good abrasion, erosion and sliding wear resistance • Excellent corrosion resistance in seawater, diluted mineral and organic acids • Used for parts applied in marine environments, petrochemical and off-shore applications, etc.
529.074	45/15		
538.074	45/15	WC-WB-Co[1 - 6] 60/30/10 Agglomerated and sintered	• HVOF • Medium WC • Wear and corrosion protection in molten metal • Used for Zn bath rolls in Continuous Galvanizing Lines (CGL) • See also ***AMPERIT***® 512
547.074	45/15	WC-Ni[2, 9, 10] 88/12 Agglomerated and sintered	• HVOF • Fine WC • Max. operating temperature 500 °C • Higher corrosion resistance than WC-Co and better ductility
547.088	53/20		
551.059	30/5	WC-CrC-Ni[2, 9, 12] 73/20/7 Agglomerated and sintered	• HVOF • Fine WC • Max. operating temperature 750 °C • Higher oxidation and corrosion resistance than pure WC-Ni-based coatings • Smooth coatings with fine microstructure and high bond strengths • Used for gate valves, etc.
551.074	45/15		
551.088	53/20		

AMPERIT® CARBIDES

for wear protection

AMPERIT®	Grain Size in µm or Specification	Chemistry / Powder Type	Typical Properties and Applications
554.067	15/5	WC-Co-Cr [1 - 6] 86/10/4 Sintered and crushed	• HVOF, HVAF, APS • Medium WC • C: 5 - 6 % • Max. operating temperature 500 °C • CoCr matrix shows higher corrosion and abrasion resistance than Co matrix • Useable in water based solutions and wet corrosive environments • Hard chrome replacement • Used for rolls, ball valves, oil field equipment, etc.
554.071	25/5		
554.054	45/10		
554.074	45/15		
556.059	30/5	WC-Co-Cr[1 - 6] 86/10/4 Agglomerated and sintered	• HVOF, HVAF • Sub-micron WC • Extremely smooth surface finish achievable • See ***AMPERIT***® 558
556.074	45/15		
NEW **557.025**	HVAF	WC-Co-Cr[1 - 6] 86/10/4 Agglomerated and sintered	• HVOF, HVAF • Medium WC • For coatings on valve components working in high pressure and salt water environments, e.g. in submarine oil&gas fields • For cavitation resistance coatings and impact tolerance, e.g. on hydroturbine runners • For ductile coatings on strained and stressed machine parts, e.g. blades, knives • See ***AMPERIT***® 558
NEW **557.059**	30/5		
NEW **557.072**	38/10		
NEW **557.074**	45/15		
558.025	HVAF	WC-Co-Cr[1 - 6] 86/10/4 Agglomerated and sintered	• HVOF, HVAF • Fine WC • Max. operating temperature 500 °C • CoCr matrix shows higher corrosion and abrasion resistance than Co matrix • Useable in water based solutions and wet corrosive environments • Smooth coatings with fine microstructure and high bond strengths • Hard chrome replacement • Used for paper rolls, gate and ball valves, hydraulic cylinders, compressor shafts, mud pump rotors
558.059	30/5		
NEW **558.072**	38/10		
558.074	45/15		
558.088	53/20		
560.062	53/10	WC-Co[1, 2, 4, 5, 6, 9, 10] NiSF 50/50 Blended	• APS, HVOF • Protection against erosion and abrasion • Used for glass mold plungers, pump plungers and sleeves, extrusion screws, steel mill rolls, etc.
560.077	63/32		
570.003	45/5	TiC Sintered and crushed	• VPS/LPPS • Dense particles • Hard and wear resistant coatings • Component for blends
575.074	45/15	(Fe,Cr)C-FeNiCrSi[2, 9, 10] 70/30 Agglomerated and sintered	• HVOF • Max. operating temperature 870 °C • Good sliding properties for machine parts, piston rods, and hard chrome replacement
580.402	PWA 1304	Cr_3C_2 Sintered and crushed	• APS • Dense particles • Max. operating temperature 870 °C • Usually blended with metals or alloys • Hard and wear resistant coatings
580.404	PWA 1306		

AMPERIT® | CARBIDES

for wear protection

AMPERIT® CARBIDES — for wear protection

AMPERIT®	Grain Size in µm or Specification	Chemistry / Powder Type	Typical Properties and Applications
584.001	45/22	Cr_3C_2-NiCr[2, 9, 10] 75/25 Agglomerated and sintered	• HVOF • Medium carbide • Max. operating temperature 870 °C • For dense oxidation and erosion resistant coatings • Good cavitation resistance • Hot gas corrosion resistant • Used for valve stems, turbine components, fuel rod mandrels, etc.
584.054	45/10		
584.072	38/10		
584.281	GE B50A845		
584.829	BMS 1067 Type 22		
585.003	45/5	Cr_3C_2-NiCr[2, 9, 10] 75/25 Blended	• APS, HVOF • Coarse dense carbide • Max. operating temperature 870 °C • Good oxidation, abrasion, particle erosion, fretting and cavitation resistance • Hot gas corrosion resistant • Used in pump housing, machine parts, hydraulic valves, tooling, hot forming dies, etc.
585.351	MSRR 9507/2		
585.357	MSRR 9507/17		
585.405	PWA 1307		
585.435	AMS 7875		
585.868	PM 819-5		
586.001	45/22	Cr_3C_2-NiCr[2, 9, 10] 80/20 Agglomerated and sintered	• HVOF • Max. operating temperature 870 °C • See ***AMPERIT***® 584 • Higher hardness than 75/25 ratio
586.054	45/10		
587	On request	Cr_3C_2-NiCr[2, 8, 9, 10] 65/35 Agglomerated and sintered	• HVOF • Max. operating temperature 870 °C • Lower hardness than 75/25 ratio
588.025	HVAF	Cr_3C_2-NiCr[2, 9, 10] 75/25 Agglomerated and sintered	• HVOF, HVAF • Max. operating temperature 870 °C • See ***AMPERIT***® 584 • Designed for kerosene guns
588.074	45/15		
588.088	53/20		
588.059	30/5		
589.025	HVAF	Cr_3C_2-NiCr[2, 8, 9, 10] 75-25 Agglomerated and sintered	• HVOF, HVAF • Max. operating temperature 870 °C • Designed for higher deposition efficiency compared to ***AMPERIT***® 588 in kerosene guns
589.074	45/15		
593.775	GE B50TF281 Cl.A	Cr_3C_2-NiCr[2, 9, 10] 90/10 Sintered and crushed	• HVOF • Max. operating temperature 870 °C • Erosion resistant coatings for aircraft tubine applications
594.074	45/15	Cr_3C_2-CoNiCrAlY[1 - 6, 9, 10] 75/25 Agglomerated and sintered	• HVOF, APS • Max. operating temperature 870 °C • Special product for heath rolls in steel industry

AMPERIT® CARBIDES

for wear protection

AMPERIT®	Grain Size in µm or Specification	Chemistry / Powder Type	Typical Properties and Applications
595.059	30/5	Cr_3C_2-NiCrMoNb[2, 8, 9, 10] 50/50 Agglomerated and sintered	• HVOF, HVAF • Matrix similar to Nickel Superalloy 625 • For dense oxidation and erosion resistant coatings • Good cavitation resistance • Hot gas corrosion resistant
595.072	38/10		
595.074	45/15		
599.063	75/45	Mo_2C Agglomerated and sintered	• APS • C: 5.8 - 6.1% • Hard ingredient in powder blends for sliding wear protection
599.074	45/15		
618.074 Green Carbides	45/15	WC-FeCrAl 85/15 Agglomerated and sintered	• HVOF • Wear resistant coating with Ni- and Co-free metallic binder, replacement for WC-Co or WC-Ni

H.C. Starck offers unique ***Amperit*® coating solutions** with customized powder properties and spray parameters for the demanding requirements of both oil&gas and hydro power applications, such as gate- and ball valves, landing gears, hydro power turbines, mud rotors, etc.

The ***Amperit*® coating solution** powders enable superior dense, crack free, and gastight coatings as well as coatings with superior cavitation resistance. Our powders linked with our unique application expertise provide integrated solutions for our customers, which fullfil the specific requirements of OEM coating specifications.

Contact us directly under **amperit.technicalsupport@hcstarck.com** to learn more about our tailor-made powder and coating solutions.

Hazards identification in Advertising (REGULATION (EC) No 1272/2008 Article 48): (1) Resp. Sens. 1; (2) Skin Sens. 1; (3) Eye Irrit. 2; (4) Repr. 2; (5) Aquatic Acute 1; (6) Aquatic Chronic 1; (7) Aquatic Chronic 2; (8) Aquatic Chronic 3; (9) Carc. 2; (10) STOT RE 1; (11) Acute Tox. 3; (12) STOT RE 2.

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AMPERIT® | OXIDES

for wear protection, chemical resistance and heat protection

***AMPERIT*® OXIDES**			**for wear protection, chemical resistance and heat protection**
***AMPERIT*®**	**Grain Size in µm or Specification**	**Chemistry / Powder Type**	**Typical Properties and Applications**
704.000	22/5	Cr_2O_3 99.5 % Fused and crushed	• APS • Hard, corrosion and wear resistant ceramic coatings • Insoluble in acids, alkalis and alcohol • Used for anilox rolls in printing machines, pump seals areas, wear rings, etc.
704.001	45/22		
704.053	CPW 320		
704.054	45/10		
704.072	38/10		
704.092	75/25		
707.000	22/5	Cr_2O_3 99.5 % Fused and crushed	• APS • Rounded particle shape • See ***AMPERIT*®** 704
707.001	45/22		
707.053	25/10		
707.054	45/10		
707.072	38/10		
707.092	75/25		
712.053	25/10	Cr_2O_3-TiO_2 75/25 Fused and crushed	• APS • Max. operating temperature 540 °C • Lower hardness but better toughness than pure Cr_2O_3 coatings • Used in wear applications where more toughness is needed
712.074	45/15		
716.054	45/10	Cr_2O_3-TiO_2-SiO_2 92/3/5 Blended	• APS • Hard, dense and wear resistant coatings • Good corrosion resistance • Higher mechanical shock resistance than pure Cr_2O_3
716.066	53/15		
740.000	22/5	Al_2O_3 Fused and crushed	• APS • Max. operating temperature 1650 °C • Resistant against corrosion, abrasion, erosion and sliding wear • Excellent dielectric properties • Stable in most acids and alkalis
740.001	45/22		
740.002	90/45		
740.003	45/5		
740.008	20/5		
740.050	< 5		
740.207	MTS 1062		
740.355	MSRR 9507/9		
740.406	PWA 1310		
742.001	45/22	Al_2O_3-TiO_2 97/3 Fused and crushed	• APS • Max. operating temperature 1100 °C • Grey alumina for use as corrosion, abrasion, erosion and sliding wear resistant coatings • Typical applications in textile machines for guiding and handling of thread, rolls in paper industry, etc.
742.059	30/5		
742.068	35/15		
742.204	MTS 1059		
742.206	MTS 1061		
742.292	GE A50TF87 Cl.A		

***AMPERIT*® OXIDES**			**for wear protection, chemical resistance and heat protection**
***AMPERIT*®**	**Grain Size in µm or Specification**	**Chemistry / Powder Type**	**Typical Properties and Applications**
742.298	GE A50TF87 Cl.B	Al_2O_3-TiO_2 97/3 Fused and crushed	• APS • Max. operating temperature 1100 °C • Grey alumina for use as corrosion, abrasion, erosion and sliding wear resistant coatings • Typical applications in textile machines for guiding and handling of thread, rolls in paper industry, etc.
742.407	PWA 1311		
742.731	DMR 33-020		
742.850	PM 819-0		
742.867	PM 819-11		
744.000	22/5	Al_2O_3-TiO_2 87/13 Blended	• APS • Max. operating temperature 540 °C • Compared with ***AMPERIT*®** 742 less hard and corrosion resistant
744.001	45/22		
744.003	45/5		
745.001	45/22	Al_2O_3-TiO_2 60/40 Blended	• APS • Max. operating temperature 540 °C • Lower hardness compared to ***AMPERIT*®** 742 and 744 • Wear and erosion resistant • Good grindability • Polished coatings with reduced wettability • Used in textile industry, household applications (pans), etc.
745.003	45/5		
745.008	20/5		
750.000	22/5	Al_2O_3-ZrO_2 60/40 Fused and crushed	• APS • High Toughness • Good abrasion and erosion resistance
782.001	45/22	TiO_2 Fused and crushed (Black)	• APS • Moderate wear resistance compared with Al_2O_3 or Al_2O_3-TiO_x • Soluble in alkalis and sulfuric acid • Decorative black coatings • Slightly conductive
782.002	90/45		
782.003	45/5		
782.054	45/10		
821.007	90/16	ZrO_2-Y_2O_3 80/20 Agglomerated and sintered	• APS • Max. operating temperature 1150 °C • Used for thermal barrier coatings, protection of graphite sheets, etc.
821.084	75/20		
825.000	22/5	ZrO_2-Y_2O_3 93/7 Fused and crushed (White)	• APS • Blocky particle shape • For dense and vertically cracked coatings
825.001	45/22		
825.218	MTS 1198		
825.242	MTS 1342		
825.381	MSRR 9507/72		
825.385			
827.006	125/45	ZrO_2-Y_2O_3 93/7 Agglomerated and sintered	• APS • Max. operating temperature 1320 °C • Color „yellow" • Very good thermal shock resistance and thermal insulating properties • Hot corrosion resistant • Used for thermal barrier coatings in aircraft, stationary gas turbines and engine applications like combustion liners and airfoils, etc. • Highest coating porosity achievable (only for A827.006) • for DVC's (non columnar) (only for A827.054)
827.007	90/16		
827.054	45/10		
827.238	MTS 1352		

AMPERIT® | OXIDES

for wear protection, chemical resistance and heat protection

AMPERIT® OXIDES			for wear protection, chemical resistance and heat protection
***AMPERIT*®**	**Grain Size in µm or Specification**	**Chemistry / Powder Type**	**Typical Properties and Applications**
827.289	GE A50TF278 Cl.A	ZrO_2-Y_2O_3 93/7 Agglomerated and sintered	• APS • Max. operating temperature 1320 °C • Color „yellow" • Very good thermal shock resistance and thermal insulating properties • Hot corrosion resistant • Used for thermal barrier coatings in aircraft, stationary gas turbines and engine applications like combustion liners and airfoils, etc.
827.290	GE A50TF278 Cl.B		
827.423	PWA 1375		
827.772	GE A50A557		
827.773	GE A50A558		
827.774	GE A50TF278 Cl.C		
827.853	PM 819-20		
827.864	PM 819-57		
827.873	PM 819-84		
827	DGTLV 504009001		
828.405	PWA 36375	ZrO_2-Y_2O_3 88/12 Agglomerated and sintered	• APS • Max. operating temperature 1150 °C • Good thermal barrier properties
831.006	125/45	ZrO_2-Y_2O_3 93/7 Plasma spherodized HOSP™	• APS • Max. operating temperature 1320 °C • Color „white", low impurities • Good thermal insulating properties • Hot corrosion resistant • Used for thermal barrier coatings in aircraft and stationary gas turbines
831.007	90/16		
NEW **831.054**	45/10		
NEW **831.290**	GE A50TF278 Cl.B		
831.733	DMR 31-098		
NEW **831.774**	GE A50TF278 Cl.C		
831	DGTLV 504009001		
849.007	90/16	Y_2O_3 Agglomerated and sintered	• APS • Stable at high temperatures • Heat resistant in aggressive atmospheres • Used for protection of graphite sheets in the hard metal industry • Max. operating temperature in air 2200 °C (on graphite 1550 °C)
849.054	45/10		
849.071	25/5		
860.074	45/15	LSM20 Agglomerated and sintered	• APS • Used for protective coatings on Cr containing interconnectors (SOFC)
865.054	45/10	MCF[1, 8] Agglomerated and sintered	• APS • Used for protective coatings on Cr containing interconnectors (SOFC) • Availability only to OEM approved users

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AMPERIT® | MCrAlYs

as bond coat and as corrosion protection for high temperature applications

AMPERIT® MCrAlYs		as bond coat and as corrosion protection for high temperature applications	
AMPERIT®	**Grain Size in µm or Specification**	**Chemistry / Powder Type**	**Typical Properties and Applications**
NEW **405.001**	45/22	NiCoCrAlYHfSi[1 - 6, 9, 10] Gas Atomized	• APS, HVOF, VPS (LPPS) • Max. operating temperature 1050 °C (VPS) or 850 °C (APS) • Stable at high temperatures in hot corrosive or oxidizing environments • Used as bond coats for TBCs, etc.
NEW **405.002**	90/45		
NEW **405.006**	125/45		
NEW **405.072**	38/10		
410.001	45/22	NiCoCrAlY[1 - 6, 9, 10] Gas Atomized	• APS, HVOF, VPS (LPPS) • Max. operating temperature 850 °C • Stable at high temperatures in hot corrosive or oxidizing environments • Used on turbine blades, etc.
410.424	PWA 1365-1		
410.429	PWA 1365-2		
410.860	PM 819-51		
413.001	45/22	NiCrAlY[2, 8, 9, 10] Gas Atomized	• APS, HVOF, VPS (LPPS) • Stable at high temperatures in hot corrosive or oxidizing environments • Used on turbine blades, etc.
413.003	45/5		
413.006	125/45		
413.284	GE B50TF192 Cl.A		
413.858	PM 819-44		
415.001	GE B50AG5	CoNiCrAlY[1 - 6, 9, 10] Gas Atomized	• APS, HVOF, VPS (LPPS) • Max. operating temperature 1050 °C (VPS) or 850 °C (APS) • Stable at high temperatures in hot corrosive or oxidizing environments • Used as bond coats for TBCs, etc.
415.002	90/45		
415.006	125/45		
415.079	90/53		
415.220	MTS 1262		
415.221	MTS 1273		
415.288	GE B50TF195 Cl.A		
415.875	PM 819-86		
416	SL-30	MCrAlY[1 - 4, 7, 9, 10] Proprietary Gas Atomized	• APS, HVOF, VPS (LPPS) • MCrAlY for stationary gas turbine applications • Availability only to OEM approved users
418	SV-20	MCrAlY[2, 8, 9, 10] Proprietary Gas Atomized	• APS, HVOF, VPS (LPPS) • MCrAlY for stationary gas turbine applications • Availability only to OEM approved users
	SH-20		
	SL-20		
421.001 *	45/22	NiCoCrAlTaReY[1 - 6, 9, 10] Gas Atomized	• APS, HVOF, VPS (LPPS) • Max. operating temperature 1050 °C (VPS) or 850 °C (APS) • Ta and Re containing MCrAlY for improved hot gas corrosion resistance
421.087 *	38/15		
421.240	MTS 1351		
421.299	GE B50TF242 Cl.A		
421.760	GE B50TF242 Cl.B[1 - 4, 7 - 9]		
421.761	GE B50TF242 Cl.C[1 - 4, 7 - 9]		
* not for US			
422	Sicoat 2231	MCrAlY[1 - 6, 9, 10] Proprietary Gas Atomized	• APS, HVOF, VPS (LPPS) • MCrAlY for stationary gas turbine applications • Availability only to OEM approved users

AMPERIT® | MCrAlYs

as bond coat and as corrosion protection for high temperature applications

***AMPERIT*® MCrAlYs**		**as bond coat and as corrosion protection for high temperature applications**	
***AMPERIT*®**	**Grain Size in µm or Specification**	**Chemistry / Powder Type**	**Typical Properties and Applications**
428	Sicoat 2453	MCrAlY(1 - 6, 9, 10) Proprietary Gas Atomized	• APS, HVOF, VPS (LPPS) • MCrAlY for stationary gas turbine applications • Availability only to OEM approved users
429	Sicoat 2464	MCrAlY(1 - 6, 9, 10) Proprietary Gas Atomized	• APS, HVOF, VPS (LPPS) • MCrAlY for stationary gas turbine applications • Availability only to OEM approved users
436	SV 349 SL 349	MCrAlY(1 - 6, 9, 10) Proprietary Gas Atomized	• APS, HVOF, VPS (LPPS) • MCrAlY for stationary gas turbine applications • Availability only to OEM approved users
469.001	45/22	CoCrAlYTaCSi (1 - 6) Gas Atomized	• APS, HVOF • Max. operating temperature 1050 °C • Excellent build-up resistance • Used on furnace rolls in steel sheet annealing
469.063	75/45		
470.001	45/22	CoCrAlYTaCSi-Al_2O_3 (1 - 6) 90/10 Blended	• APS • Max. operating temperature 1050 °C • Excellent build-up resistance • Better wear resistance than ***AMPERIT***® 469 • Used on furnace rolls in steel sheet annealing
470.054	45/10		
471.074	45/15	CoCrAlYTaCSi-Al_2O_3 (1 - 6) 90/10 Agglomerated and sintered	• HVOF (gas fueled) • Max. operating temperature 1050 °C • Homogeneous distribution of fine Al_2O_3 particles • Excellent build-up resistance • Good wear resistance at high temperature and thermal shock resistance • Used on furnace rolls in steel sheet annealing

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AMPERIT® | MOLYBDENUM

for automotive applications

AMPERIT® MOLYBDENUM			for automotive applications
AMPERIT®	**Grain Size in µm or Specification**	**Chemistry / Powder Type**	**Typical Properties and Applications**
105.002	90/45	Molybdenum Agglomerated and sintered	• APS • Max. operating temperature 320 °C (in oxidizing atmospheres) • C max. 0.2 % • Tough coatings with acceptable hardness and excellent sliding properties • Good bond strength • Used for valves, synchronizers, piston rings, pump parts, etc.
105.074	45/15		
105.091	150/45		
106.002	90/45	Molybdenum Sintered and crushed	• APS • Max. operating temperature 320 °C (in oxidizing atmospheres) • Dense blocky grains • Tough coatings with acceptable hardness and excellent sliding properties • Good bond strength • Used for valves, synchronizers, piston rings, pump parts, etc.
106.062	53/10		
106.158	PWA 1313		
106.222	MTS 1054		
106.282	GE 401-3083-630		
106.707	CPW 213		
106.870	PM 819-13		
109.063	75/45	Molybdenum Agglomerated and sintered	• APS • Max. operating temperature 320 °C (in oxidizing atmospheres) • C max. 1% • See ***AMPERIT***® 105
109.066	53/15		
109.832	BMS 1067 Type 21		
110.002	90/45	Mo-Mo_2C Agglomerated and sintered	• APS • Max. operating temperature 320 °C (in oxidizing atmospheres) • C: 2.2 - 2.4 % • Tough coatings with high hardness, excellent sliding properties and good wear resistance
110.074	45/15		
119.075	90/15	Mo-NiSF[2, 9, 10] 75/25 Blended	• APS, HVOF • Max. operating temperature 350 °C • Wear resistant coatings with excellent sliding properties • Low friction coefficient • Used for piston rings, etc.

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AMPERIT® | PURE METALS, ALLOYS & OTHERS

AMPERIT® PURE METALS, ALLOYS & OTHERS

AMPERIT®	Grain Size in µm or Specification	Chemistry / Powder Type	Typical Properties and Applications
140.001	45/22	Tungsten Sintered	• VPS (LPPS) • Corrosion resistant against acids • Good high temperature stability in non-oxidizing atmospheres • High melting point • Good adhesion to graphite, alumina and quartz
140.002	90/45		
140.003	45/ 5		
140.067	15/5		
140.071	25/ 5		
150.002	90/45	Tantalum[13] Fused and crushed	• VPS (LPPS), APS • Corrosion protection for chemical equipment against acids
150.074	45/15		
151.065	30/10	Tantalum[13] Special Grade	• Cold Spray • Dense coatings for highest corrosion protection against sulfuric acid • Improved mechanical properties • High deposition efficiency • Corrosion protection for chemical equipment against acids
154.007	90/16	Titanium[13]	• VPS (LPPS) • Good corrosion resistance against salt water, Cl containing solutions and oxidizing acid solutions • High purity • Conforms to ASTM F-1580 • Material for biomedical applications
154.093	125/90		
154.096	355/200		
155.086	< 63	Titanium[13]	• VPS (LPPS) • Good corrosion resistance against salt water, Cl containing solutions and oxidizing acid solutions • Material for biomedical applications
155.093	125/90		
160.003	45/5	Niobium[13] Fused	• VPS (LPPS) • Corrosion resistant against several acids • Good high temperature stability in non-oxidizing atmospheres
170.084	75/20	Silicon	• Bond Coat for EBC coatings
170.266	GE A50TF350		
175.001	45/22	Nickel[2, 8, 9, 10] Water Atomized	• APS, HVOF • Max. operating temperature 530 °C in air • Good corrosion protection • Repair and bond coat for Ni-based alloys
175.002	90/45		
176.001	45/22	Nickel[2, 8, 9, 10] Gas Atomized	• APS, HVOF, HVAF • Repair and build-up for Ni-based alloy components
176.068	35/15		
200.268	GE B50TF164 Cl.A	Ni-Graphite[2, 8, 9, 10] 60/40 Dense Coated	• Flame • Max. operating temperature 480 °C • Self-lubricating • Abradable for clearance control of turbine components
200.269	GE B50TF164 Cl.B		

AMPERIT® PURE METALS, ALLOYS & OTHERS

AMPERIT®	Grain Size in µm or Specification	Chemistry / Powder Type	Typical Properties and Applications
205.005	106/32	Ni-Graphite[2, 8, 9, 10] 75/25 Dense Coated	• Flame • Max. operating temperature 480 °C • Self-lubricating • Abradable for clearance control of turbine components
205.276	GE B50TF52 Cl.B		
205.415	PWA 1352/1		
207.270	GE B50TF53 Cl.B	Ni-Graphite[2, 8, 9, 10] 85/15 Dense Coated	• Flame • Max. operating temperature 480 °C • Self-lubricating • Higher erosion resistance • Abradable for clearance control of turbine components
207.421	PWA 1352/2		
207.869	PM 819-34		
250.001	45/22	NiCr[2, 8, 9, 10] 80/20 Water Atomized	• APS, Flame • Max. operating temperature 980 °C • Oxidation and corrosion resistant • Good machinability • Used for repair, bond coat and corrosion protection
250.002	90/45		
250.071	25/5		
250.200	MTS 1050		
250.354	MSRR 9507/8		
250.410	PWA 1317		
250.411	PWA 1319		
250.425	PWA 1303		
250.428	PWA 1315		
251.001	45/22	NiCr[2, 8, 9, 10] 80/20 Gas Atomized	• APS, HVOF • Spherical alternative to ***AMPERIT***® 250 • Better flowability
251.002	90/45		
251.051	12/5		
280.001	45/22	NiAl[2, 8, 9, 10] 95/5 Water Atomized	• APS, Flame • Max. operating temperature 800 °C • Oxidation and abrasion resistant • Excellent machinability
280.002	90/45		
280.003	45/5.5		
280.241	MTS 1309		
280.287	GE B50TF56 Cl.B		
280.616	DHS 122-101		
280.732	DMR 31-011		
281.002	90/45	NiAl[2, 8, 9, 10] 95/5 Gas Atomized	• APS, HVOF • Spherical alternative to ***AMPERIT***® 280 • Better flowability
281.003	45/5		
281.006	125/45		
281.267	GE B50TF56 Cl.C		
281.390	MSRR 9507/5		
281.420	PWA 1380		
281.863	PM 819-56		

AMPERIT® | PURE METALS, ALLOYS & OTHERS

AMPERIT® PURE METALS, ALLOYS & OTHERS

	AMPERIT®	Grain Size in µm or Specification	Chemistry / Powder Type	Typical Properties and Applications
	291.003	45/5	NiAl[2, 8, 9, 10] 69/31 Fused and crushed	• APS • Used as bond coat for various applications • Good corrosion resistance • High bond strength
	291.008	20/5		
	291.059	30/5		
NEW	**340.002**	90/45	CoMoCrSi[1 - 6] (Similar to T-400) Gas Atomized	• HVOF, APS • Excellent dry sliding properties • Corrosion and oxidation resistant • Used for bearing journals and guide tracks
	340.074	45/15		
	340.088	53/20		
NEW	**342.002**	90/45	CoMoCrSi[1 - 6] (Similar to T-800) Gas Atomized	• HVOF, APS • Excellent dry sliding properties • Corrosion and oxidation resistant • Used for bearing journals and guide tracks
	342.074	45/15		
	342.088	53/20		
NEW	**344.088**	53/20	CoCrWSiC[1 - 6] (Co Hardfacing Alloy #6) Gas Atomized	• HVOF • Excellent wear and thermal shock resistance • Excellent corrosion and shock oxidation resistance • Used in valve seals, steam turbines, machine parts
	377.002	90/45	FeCrNiMo[2, 9, 10] (Stainless Steel similar to 316 L) Gas Atomized	• Used for corrosion and cavitation protection as well as contour restauration
NEW	**377.065**	30/10		
	377.074	45/15		
	377.088	53/20		
	380.002	90/45	NiCrMoNb[2, 8, 9, 10] (Ni Superalloy 625) Gas Atomized	• HVOF, HVAF, APS, Cold Spray • Max. operating temperature 1000 °C • Excellent oxidation and corrosion resistance • Used in boilers and in chemical industry
	380.074	45/15		
	380.088	53/20		
	381.071	25/5	FeVCrCWMoMnSi Gas Atomized	• HVOF, HVAF • Excellent sliding properties for machine parts, piston rods, and hard chrom replacement • For applications without wet corrosion resistance requirements
NEW	**381.088**	53/20		
	407.088	53/20	NiCrMoNbAlTi[2, 8, 9, 10] (Ni Superalloy 718) Gas Atomized	• HVOF , Cold Spray, APS • Excellent for corrosion resistant coatings • Hardenable • Very good for high temperature applications • Used in turbines and chemical equipment
NEW	**407.291**			
	409.002	90/45	NiCrMoNbAlTi[2, 8, 9, 10] (Ni Superalloy C-276) Gas Atomized	• HVOF, HVAF, Cold Spray, APS • Excellent for corrosion resistant coatings • Used in chemical equipment in corrosive environments
	409.074	45/15		
NEW	**409.088**	53/20		

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AMPERIT® | AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT® Alstom

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Material (Alstom)	Specification
416*	MCrAlY Proprietary	SL30	HTCT 650559
418*	MCrAlY Proprietary	SV20	HTCT 650557
418*	MCrAlY Proprietary	SH20	HTCT 650515
418*	MCrAlY Proprietary	SL20	HTCT 650565
436*	MCrAlY Proprietary	SL349	HTCT 650581
436*	MCrAlY Proprietary	SV349	HTCT 650585
584*	Cr_3C_2-NiCr 75-25		HTCT 650560
587*	Cr_3C_2-NiCr 65-35		HTCT 650560
827*	ZrO_2-Y_2O_3	SS-93-07	HTCT 650564

* Please contact sales office

AMPERIT® CPWA

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification
106.707	Mo	CPW 213
282.705*	Ni-Al 95-5	CPW 247
704.053	Cr_2O_3	CPW 320
410.429	NiCoCrAlY	CPW 387

* Available on request

AMPERIT® GE AVIATION

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

	AMPERIT®	Material	Specification	Class
	106.282	Mo	401-3083-630	A
NEW	**165.965**	Re	GE B50TF260	A
	170.266	Silicium	GE A50TF350	A
NEW	**825.289**	ZrO_2-Y_2O_3	GE A50TF278	A
NEW	**825.290**	ZrO_2-Y_2O_3	GE A50TF278	B
NEW	**825.774**	ZrO_2-Y_2O_3	GE A50TF278	C
NEW	**831.289**	ZrO_2-Y_2O_3	GE A50TF278	A
NEW	**831.967**	ZrO_2-Y_2O_3	GE A50TF278	D
	831.290	ZrO_2-Y_2O_3 93-7	GE A50TF278	B
	831.774	ZrO_2-Y_2O_3 93-7	GE A50TF278	C
	827.293*	ZrO_2-Y_2O_3 93-7	GE A50TF204	C
	827.289	ZrO_2-Y_2O_3 93-7	GE A50TF278	A
	827.290	ZrO_2-Y_2O_3 93-7	GE A50TF278	B
	827.774	ZrO_2-Y_2O_3 93-7	GE A50TF278	C

AMPERIT® | AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT® GE AVIATION

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification	Class
742.292	Al_2O_3-TiO_2 97-3	GE A50TF87	A
742.298	Al_2O_3-TiO_2 97-3	GE A50TF87	B
NEW **742.966**	Al_2O_3-TiO_3	GE A50TF87	C
200.268	Ni-C 60-40	GE B50TF164	A
200.269	Ni-C 60-40	GE B50TF164	B
NEW **203.978**	Ni-C	GE B50TF172	A
205.276	Ni-C 75-25	GE B50TF52	B
NEW **205.970**	Ni-C 75-25	GE B50TF52	A
207.270	Ni-C 85-15	GE B50TF53	B
NEW **207.971**	Ni-C 85-15	GE B50TF53	A
280.287	Ni-Al 95-5	GE B50TF56	B
NEW **280.972**	Ni-Al 95-5	GE B50TF56	C
286.295	Ni-Al	GE B50TF33	A
NEW **380.993**	Ni-SA 625	GE B50TF270	A
NEW **250.968**	Ni-Cr	GE B50TF40	A
NEW **250.969**	Ni-Cr	GE B50TF40	B
NEW **251.968**	Ni-Cr	GE B50TF40	A
NEW **251.969**	Ni-Cr	GE B50TF40	B
NEW **442.974**	NiCrSi	GE B50TF81	A
NEW **442.975**	NiCrSi	GE B50TF81	B
NEW **413.284**	NiCrAlY	GE B50TF162	A
413.284	NiCrAlY	GE B50TF192	A
NEW **413.981**	NiCrAlY	GE B50TF192	B
415.288	CoNiCrAlY	GE B50TF195	A
407.291*	Ni-SA 718	GE B50TF202	B
NEW **407.987**	Ni-SA 718	GE B50TF202	A
NEW **407.988**	Ni-SA 718	GE B50TF202	D
421.299	NiCoCrAlTaReY	GE B50TF242	A
421.760	NiCoCrAlTaReY	GE B50TF242	B
421.761	NiCoCrAlTaReY	GE B50TF242	C
NEW **421.992**	NiCoCrAlTaReY	GE B50TF242	D
NEW **445.980**	NiCoCrAlMoWTi (Rene 80)	GE B50TF183	A
NEW **481.984**	CoCrAlHf	GE B50TF201	A
NEW **481.985**	CoCrAlHf	GE B50TF201	B
NEW **481.986**	CoCrAlHf	GE B50TF201	C

AMPERIT® GE AVIATION

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification	Class
518.280	WC-Co 88-12	GE B50TF27	A
518.768	WC-Co 88-12	GE B50TF27	B
591.294*	Cr_3C_2/Ni-NiCoCrMoSiB-Ni/Al	GE B50TF28	A
593.775	Cr_3C_2-NiCr 90-10	GE B50TF281	A
528.764	WC-Co 90-10	GE B50TF295	A

* Available on request

AMPERIT® GE POWER & WATER

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification
106.282	Mo	401-3083-630
827.772	ZrO_2-Y_2O_3 93-7	GE A50A557
827.773	ZrO_2-Y_2O_3 93-7	GE A50A558
584.281	Cr_3C_2-NiCr 75-25	GE B50A845
413.265	NiCrAlY	GE B50A892
415.001	CoNiCrAlY	GE B50AG5

AMPERIT® MTU

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification	Remarks
250.200	Ni-Cr 80-20	MTS 1050	
106.222	Mo	MTS 1054	
515.203	WC-Co 88-12	MTS 1055	
526.223	WC-Co 83-17	MTS 1058	
742.204	Al_2O_3-TiO_2 97-3	MTS 1059	
742.206	Al_2O_3-TiO_2 97-3	MTS 1061	
740.207	Al_2O_3	MTS 1062	
204.215	Ni-C 85-15	MTS 1071	
825.218	ZrO_2-Y_2O_3 93-7	MTS 1198	
704.216*	Cr_2O_3	MTS 1231	
415.220	CoNiCrAlY	MTS 1262	

AMPERIT® | AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT® MTU

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification	Remarks
415.221	CoNiCrAlY	MTS 1273	
280.241*	Ni-Al 95-5	MTS 1309	
825.242	ZrO_2-Y_2O_3 93-7	MTS 1342	
421.240	NiCoCrAlTaReY	MTS 1351	
827.238	ZrO_2-Y_2O_3 93-7	MTS 1352	
281.245*	Ni-Al 95-5	MTS 1519	listed in MTS 1519 as 281.090
413.247*	NiCrAlY	MTS 1545	listed in MTS 1545 as 413.1

* Available on request

AMPERIT® PWA

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification	*AMPERIT*®	Material	Specification
515.401	WC-Co 88-12	PWA 1302	**205.415**	Ni-C 75-25	PWA 1352-1
250.425	Ni-Cr 80-20	PWA 1303	**207.421**	Ni-C 85-15	PWA 1352-2
580.402	Cr_3C_2	PWA 1304	**588.419***	Cr_3C_2-NiCr 75-25	PWA 1364
580.404	Cr_3C_2	PWA 1306	**410.424**	NiCoCrAlY	PWA 1365-1
585.405	Cr_3C_2-NiCr 75-25	PWA 1307	**410.429**	NiCoCrAlY	PWA 1365-2
740.406	Al_2O_3	PWA 1310	**515.400**	WC-Co 88-12	AMS 7879
742.407	Al_2O_3-TiO_2 97-3	PWA 1311	**585.435**	Cr_3C_2-NiCr 75-25	AMS 7875
106.158	Mo	PWA 1313	**827.423**	ZrO_2-Y_2O_3 93-7	PWA 1375
250.428	Ni-Cr 80-20	PWA 1315	**281.420**	Ni-Al 95-5	PWA 1380
348.430	Co-Hartleg. 31	PWA 1316	**526.454**	WC-Co 83-17	PWA 36331-1
250.410	Ni-Cr 80-20	PWA 1317	**828.405**	ZrO_2-Y_2O_3 88-12	PWA 36375
348.431*	Co-Hartleg. 31	PWA 1318	**Special**	Cr_2O_3-Al_2O_3 70-30	PWA 36376
250.411	Ni-Cr 80-20	PWA 1319			
146.412*	Cr	PWA 1331			

* Available on request

AMPERIT® Rolls Royce

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification	*AMPERIT*®	Material	Specification
526.350	WC-Co 83-17	MSRR 9507 / 1	**825.381***	ZrO_2-Y_2O_3 93-7 "white"	MSRR 9507 / 72
585.357	Cr_3C_2-NiCr 75-25	MSRR 9507 / 17	**825.385***	ZrO_2-Y_2O_3 93-7 "yellow"	MSRR 9507 / 72
585.351	Cr_3C_2-NiCr 75-25	MSRR 9507 / 2	**250.354***	Ni-Cr 80-20	MSRR 9507 / 8
281.390	Ni-Al 95-5	MSRR 9507 / 5	**740.355**	Al_2O_3	MSRR 9507 / 9
526.382	WC-Co 83-17	MSRR 9507 / 69			

* Available on request

AMPERIT® Siemens

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Material (Siemens)	Specification
422	MCrAlY Proprietary	SICOAT 2231	DGTLV 511 114-001
428	MCrAlY Proprietary	SICOAT 2453	DGTLV 511 114-001
429	MCrAlY Proprietary	SICOAT 2464	DGTLV 511 114-001
827	ZrO_2-Y_2O_3 93-7		DGTLV 504 009-001
831	ZrO_2-Y_2O_3 93-7		DGTLV 504 009-001

AMPERIT® SNECMA

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification
280.732	NiAl 95-5	DMR 33-011
526.729	WC-Co 83-17	DMR 33-019
526.727	WC-Co 83-17	DMR 33-501
742.731	Al_2O_3-TiO_2	DMR 33-020
831.733	ZrO_2-Y_2O_3 93-7	DMR 33-098

AMPERIT® Volvo

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

AMPERIT®	Material	Specification	*AMPERIT*®	Material	Specification
742.850	Al_2O_3-TiO_2 97-3	PM 819-0	**585.868**	Cr_3C_2-NiCr 75-25	PM 819-5
515.851	WC-Co 88-12	PM 819-1	**410.860**	NiCoCrAlY	PM 819-51
742.867	Al_2O_3-TiO_2 97-3	PM 819-11	**515.851**	WC-Co 88-12	PM 819-53
106.870	Mo	PM 819-13	**281.863**	Ni-Al 95-5	PM 819-56
827.853	ZrO_2-Y_2O_3 93-7	PM 819-20	**827.864**	ZrO_2-Y_2O_3 93-7	PM 819-57
518.874	WC-Co 88-12	PM 819-25	**827.873**	ZrO_2-Y_2O_3 93-7	PM 819-84
207.869	Ni-C 85-15	PM 819-34	**415.875**	CoNiCrAlY	PM 819-86
413.858	NiCrAlY	PM 819-44	**416.877**	NiCoCrAlSiTaY	PM 819-87

* Available on request

AMPERIT® Others

AIRCRAFT APPROVALS AND TURBINE SPECIFICATIONS

Customer	*AMPERIT*®	Material	Specification	Type	Remarks
Allied Signal	**827.774**	ZrO_2-Y_2O_3 93-7	EMS57750	Type 1	
Boeing	**109.832**	Mo	BMS 1067	Type 21	
Boeing	**515.830**	WC-Co 88-12	BMS 1067	Type 1	listed as 515.400
Boeing	**526.831**	WC-Co 83-17	BMS 1067	Type 1	listed as 526.062
Boeing	**584.829**	Cr_3C_2-NiCr 75-25	BMS 1067	Type 22	
De Haviland	**526.781**	WC-Co 83-17	DHMS C4.19		listed as 526.062
McDonnel Douglas	**515.949**	WC-Co 88-12	DMS2049	Type 2	
McDonnel Douglas	**920.894***	$MoSi_2$	DMS2049	Type 3	
McDonnel Douglas	**526.895**	WC-Co 83-17	DMS2049	Type 5	

* Available on request

AMPERIT® | UNITS

AMPERIT® Grain Size Code Guide

Grain Size Code	Grain Size Range in µm	Grain Size Code	Grain Size Range in µm	Grain Size Code	Grain Size Range in µm
.000	22/5	.060	300/200	.081	106/53
.001	45/22	.061	150/53	.082	125/10
.002	90/45	.062	53/10	.083	125/38
.003	45/5	.063	75/45	.084	75/20
.004	63/16	.064	106/45	.085	106/20
.005	106/32	.065	30/10	.086	<63
.006	125/45	.066	53/15	.087	38/15
.007	90/16	.067	15/5	.088	53/20
.008	20/5	.068	35/15	.089	45/20
.025	HVAF only	.069	40/10	.090	Customized grain size (on request)
.049	300/45	.070	63/10		
.050	<5	.071	25/5	.091	150/45
.051	12/5	.072	38/10	.092	75/25
.052	20/5	.073	150/63	.093	125/90
.053	25/10	.074	45/15	.094	106/38
.054	45/10	.075	90/15	.095	200/106
.055	106/10	.076	12/2	.096	355/200
.056	100/60	.077	63/32	.099	Customized grain size (fine, on request)
.057	150/5	.078	75/15		
.058	<15	.079	90/53		
.059	30/5	.080	106/10		

Mesh to micron conversion chart

U.S. mesh	Microns	U.S. mesh	Microns	U.S. mesh	Microns
3	6730	18	1000	80	177
4	4760	20	841	100	149
5	4000	25	707	120	125
6	3360	30	595	140	105
7	2830	35	500	170	88
8	2380	40	400	200	74
10	2000	45	354	230	63
12	1680	50	297	270	53
14	1410	60	250	325	44
16	1190	70	210	400	37

Mass

1 ounce (oz.)	28.35 g	**1 g**	0.0353 oz.
1 pound (lb.)	0.45359 kg	**1 kg (= 1000 g)**	2.205 lb.
1 ton (short ton US)	907.185 kg	**1 to (= 1000 kg)**	1.102 ton (short ton US)

Density

1 lb.mass/in.^{3}	27.68 g/cm^3	**1 g/cm^3**	0.362 lb.mass/in.^{3}
1 lb.mass/ft.^{3}	0.016 g/cm^3	**1 g/cm^3**	62.4 lb.mass/ft.^{3}

Temperature Conversion

Kelvin (K)	Centigrade (°C)	Fahrenheit (°F)
273	0	32
373	100	212

C = K - 273.15	K = C + 273.15	F = 1.8C + 32	C = (F-32) / 1.8

Thermotechnical units

1 B.t.u.	0.252 kcal	1.05506 kJ	**1 kJ**	0.2388 kcal	0.9477 B.t.u
1 B.t.u./lb-mass	0.556 kcal/kg	2.329 kJ/kg	**1 kJ/kg**	0.2388 kcal/kg	0.4298 B.t.u./lb-m.

Pressure

	1 Pa = 1 N/m^2	**1 bar** = 1 Mdyn/cm^2	**1 at** = 1 kp/cm^2	**1 atm** = 1 p_{STP}	**1 Torr** = 1 mm_{Hg}	**1 psi** = 1 lb_F/in^2
1 Pa	**1**	$1.0000 \cdot 10^{-5}$	$1.0197 \cdot 10^{-5}$	$9.8692 \cdot 10^{-6}$	$75006 \cdot 10^{-3}$	$1.4504 \cdot 10^{-4}$
1 bar	$1.0000 \cdot 10^{5}$	**1**	$1,0197 \cdot 10^{0}$	$9.8692 \cdot 10^{-1}$	$7.5006 \cdot 10^{2}$	$1.4504 \cdot 10^{1}$
1 at	$9.8067 \cdot 10^{4}$	$9.8067 \cdot 10^{-1}$	**1**	$9.6784 \cdot 10^{-1}$	$7,3556 \cdot 10^{2}$	$1.4223 \cdot 10^{1}$
1 atm	$1.0133 \cdot 10^{5}$	$1.0133 \cdot 10^{0}$	$1.0332 \cdot 10^{0}$	**1**	$7.6000 \cdot 10^{2}$	$1.4696 \cdot 10^{1}$
1 Torr	$1.3332 \cdot 10^{2}$	$1.3332 \cdot 10^{-3}$	$1.3595 \cdot 10^{-3}$	$1.3158 \cdot 10^{-3}$	**1**	$1.9337 \cdot 10^{-2}$
1 psi	$6.8948 \cdot 10^{3}$	$6.8948 \cdot 10^{-2}$	$7.0307 \cdot 10^{-2}$	$6.8046 \cdot 10^{-2}$	$5,1715 \cdot 10^{1}$	**1**

Volume

1 m^3	= 1000 l	**1 in^3**	= 0.0164 l
1 l	= 10 dl	**1 l**	= 0.2642 US gal
1 US gallon	= 3.7854 l	**1 l**	= 0.0353 ft^3
1 ft^3	= 28.3168 l	**1 l**	= 61.0237 in^3

Gas Flow

1 scfh (70 °F)	= 0.4719 slpm (70 °F)	= 0.4381 nl/min (0 °C)
1 nl/min (0 °C)	= 1.0773 slpm (70 °F)	= 2.2826 scfh (70 °F)

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