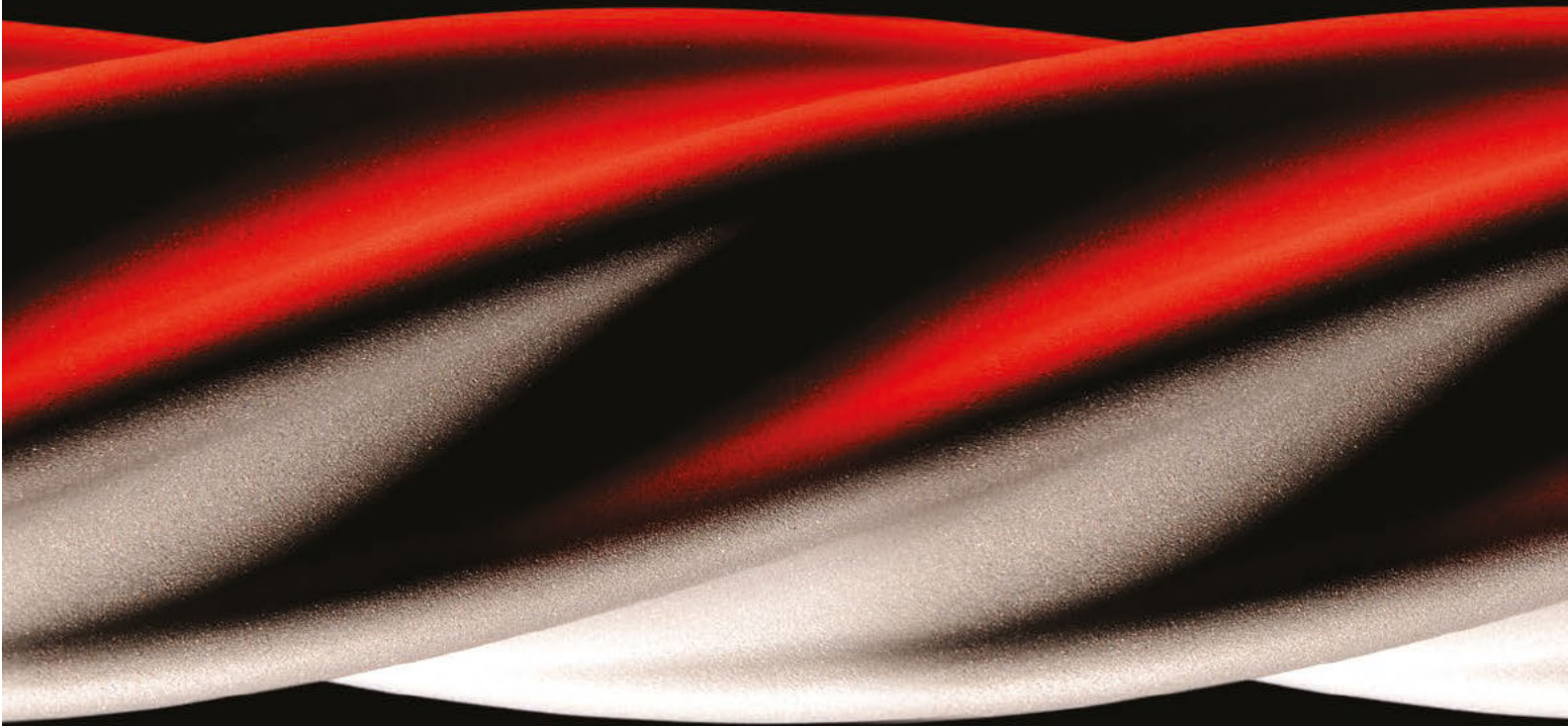


chemically formed **ceramic** coatings



Bodycote

Bodycote offers a unique range of thermochemically formed ceramic coatings for the prevention of wear and corrosion in a wide variety of industrial applications and for every type of surface.

Bodycote's ceramic coatings, which includes the K-Tech coatings range, have been uniquely developed for applications in specific industries. Several formulae cover a virtually limitless number of potential applications which can be applied to most ferrous and some non-ferrous metals.



Advanced surface technology

Bodycote's thermochemically formed ceramic coatings represent a significant advance in surface engineering technology.

These exceptionally hard and wear-resistant coatings offer a number of advantages compared with other ceramics:

- Substantially improved component lifetime
- Chemically, not mechanically, bonded
- Absolutely dense, pore free, corrosion barriers
- Effective coating of complex geometries and internal bores
- Low friction; the coated surface is anti-fouling
- Protection from highly corrosive environments and chemical attack
- Superior sliding wear resistance and high electrical resistivity
- Extremely fine grain structure



Your wear and corrosion challenges... solved

Bodycote's thermochemically formed ceramic coatings can offer a solution for wear and corrosion problems across a wide range of market sectors and applications, delivering up to 25 times longer lifetime for your components.

Providing hardness of up to 2850 Hv, bond strength in excess of 10,000 PSI and salt spray resistance of over 3,000 hours, Bodycote ceramics outperform other commercially available coatings.

Many coatings from the Bodycote ceramics range are applied with no measurable build up and offer resistance to thermal cycling/shock and low friction, adjustable surface finishes.

Bodycote has also introduced Tech100 Polymer, a liquid dispersion coating based on PEEK™ polymer – one of the highest performing thermoplastics in the world. FDA-approved, Tech100 offers exceptional scratch, wear and corrosion resistance and has outperformed peer coatings in wear and abrasion tests.

How does it work?

The application of Bodycote ceramics is tailored according to the substrate and end use requirement of the component.

Tech10 and Tech12 bond the ceramic with the metal surface by etching and penetrating into the surface grain boundaries, producing a ceramic oxide-to-metal bond which is exceptionally strong.

Some composite ceramics can be thermochemically bonded to specific areas on a part, including outside/inside diameters and some hidden holes and ports. These ceramics develop a bond into the substrate through the formation of a spinel-like interface between the ceramic coating and the metal surface.

In some cases, such as Tech17, the ceramic is used to seal existing coatings such as chrome and tungsten carbide. The ceramic seal is applied by saturating the coated area with a chemical solution at room temperature. These chemicals are then converted into ceramic by a low temperature firing process resulting in a reaction whereby the ceramic chemically bonds to both the coating and the substrate, filling any microporosity and preventing corrosives from attacking the substrate via blistering and undermining of the coating.



The Bodycote ceramic coatings range

	Tech10	Tech12	Tech17 (Chrome Seal)	Tech17 (HVOF Seal)	Tech18	Tech22	Tech23	Tech28E	Tech40	Tech100 (Polymer)
Technical data										
Max Hardness	Up to 2850 Hv	Up to 2850 Hv	1050-1150 Hv	Dependent upon hardness of the coating/plating being sealed	Up to 2450 Hv	1000-1850 Hv	1000-1850 Hv	1000-1800 Hv	1000-2850 Hv	D85 (Shore D)
Bond strength	> 10,000 PSI	> 10,000 PSI	Up to 10,000 PSI	Up to 28% improvement	> 10,000 PSI	> 10,000 PSI	> 10,000 PSI	> 10,000 PSI	> 10,000 PSI	
Thickness	2 - 3 microns	2 - 3 microns	< 5 microns	2 - 3 microns	13-38 microns	50-70 microns	50-70 microns	30-50 microns	50-70 microns	
Coefficient of friction	.22 - .28 (fibre) .10 - .13 (metal)	.22 - .28 (fibre) .10 - .13 (metal)	n/a	n/a	< .2 (fibre)	.22 - .28 (fibre) .10 - .13 (metal)	.22 - .28 (fibre) .10 - .13 (metal)	.25 - .29 (fibre) .10 - .13 (metal)	.22 - .28 (fibre)	0.18
Key benefits										
Corrosion resistance		Impervious to H ₂ S	> 1,000 hrs salt spray	> 9,000 hrs salt spray	Low		Excellent against most acids and impervious to H ₂ S	> 9,000 hrs salt spray		
Wear resistance	Sliding	Sliding and rotational: moderate	Extreme	Up to 30% improvement	Excellent	Sliding and rotational: excellent	Sliding and rotational: excellent	Moderate	Sliding: extreme	Excellent
Resistant to thermal cycling/shock		✓				✓	✓	✓	✓	
Low friction	✓	✓		✓	✓	✓	✓	✓	✓	✓
Anti-fouling		✓	✓	✓			✓	✓		
Minimal dimensional change	✓	✓	✓	✓						
Life extension	Up to 10x	Up to 10x	4-10 x	2-5 x	2-5 x	Up to 25x	Up to 25x	Up to 10x		
Ideal for...	Light pressure wear applications	Light to moderate wear, corrosion and galling applications	Sealing hard chrome plating; high chloride duties	Sealing other types of coatings, e.g. thermal spray coatings which operate in high chloride environments	Gears and high load surfaces	Sliding surfaces and rotational wear applications	Extending wear life in corrosive environments	Electrical resistivity	Sliding surfaces and rotational wear applications	Equipment and machinery parts needing ultimate protection
Features	Etches and penetrates into surface grain boundaries. Forms exceptionally strong ceramic oxide to metal bond. Does not typically require pre-machining.	Etches and penetrates into surface grain boundaries. Forms exceptionally strong ceramic oxide to metal bond. Does not typically require pre-machining.	Fills and seals micro-cracking and porosity in hard chrome plating. Thermochemically diffuses throughout the chrome plate, filling porosity with corrosion resistant, super-hard ceramic particles. Prevents corrosives from attacking the substrate through undermining and blistering of the plating.	Fills and seals micro-cracking and porosity in metallurgical coatings. Thermochemically diffuses throughout the coating, filling porosity with corrosion resistant, super-hard ceramic particles. Prevents corrosives from attacking the substrate through undermining and blistering of the plating. Excellent in H ₂ S, CO ₂ and high chloride environments.	Unique, porous oxide is created at substrate surface; porosity is filled using ceramic particles. Unique feature of Tech18 is its ability to harden the metal below the ceramic. Chemical reactions cause the ceramic to be chemically bonded to the substrate material.	Composite ceramic, bonded to specific areas on a part, including some hidden holes and ports. Individual ceramic particles are sub-micron in size and consist of selected ceramic materials, bonded together and to the substrate. Develops a bond into the substrate through the formation of a spinel-like interface between ceramic coating and metal surface.	Composite ceramic, bonded to specific areas on a part, including some hidden holes and ports. Individual ceramic particles are sub-micron in size and consist of selected ceramic materials, bonded together and to the substrate. Almost totally dense ceramic with no open porosity, making the part impervious to chemical attack.	Unique combination of particle hardness, density, chemical bonding, and lack of porosity result in a coating which is both durable and chemically resistant. Slight surface profile allows lubrication of mechanical seals. Field use in gap subs, antennas and insulation rings proves that Tech28E can insulate housings and other components from typical down-hole conditions.	Composite ceramic, bonded to specific areas on a part, including some hidden holes and ports. Individual ceramic particles are sub-micron in size and consist of selected ceramic materials, bonded together and to the substrate. Develops a bond into the substrate through the formation of a spinel-like interface between ceramic coating and metal surface.	Liquid dispersion coating, based on PEEK™ polymer, widely regarded as one of the highest performing thermoplastics in the world. Provides exceptional scratch, wear and corrosion resistance, low friction, anti-stick, high temperature performance, strength and durability. FDA-approved coating grade, which outperforms peer polymer coatings.
Industry applications	Oil & gas, plastic injection & extrusion, pump, textile, pulp paper, power generation, automotive, valve	Oil & gas, plastic injection & extrusion, pump, textile, pulp paper, power generation, automotive, valve	Oil & gas exploration	Oil & gas, plastic injection & extrusion, pump, textile, pulp paper, power generation, automotive, valve	Oil & gas, plastic injection & extrusion, pump, textile, pulp paper, power generation, automotive, valve	Oil & gas, plastic injection & extrusion, pump, textile, pulp paper, power generation, automotive, valve	Oil & gas, plastic injection & extrusion, pump, textile, pulp paper, power generation, automotive, valve	Oil & Gas	Oil & gas, automotive, textile, wire drawing, chemical, steel, plastic injection moulding, pump, glass.	Oil & Gas, automotive, pump, printing, textiles, electronics, nuclear, food processing, pharmaceutical

Our quality meets your standards

We never forget that our customers have invested time, money and resources in all the components we process, which is why quality comes as a standard part of our service, ensuring that all our customers' components are treated with care throughout.

Our facilities hold numerous international, national and customer approvals appropriate to the services they offer and the markets they serve.

Our customers can be confident their demands can be met, however stringent, with assured quality, cost-effectiveness and on-time completion every time.



Precision finishing

The precision nature of ceramic coating and any associated thermal spray coating requires accurate measurement, finishing and quality inspection. Together with daily monitoring of coating parameters and metallographic quality this accuracy ensures that our coatings are of the highest integrity.

Our facilities are equipped with precision machining and finishing machines capable of coating removal for repair of worn components, and post-coating finishing to the highest standards.



Typical applications



Oil & Gas exploration

Bodycote ceramics are extremely cost effective where expensive downtime is caused by component corrosion and wear. Applications include down-hole tools, mud rotors, pump sleeves, MWD (measurement while drilling) equipment, and various valve components. Internal bore applications such as valve actuators and hydraulic jars, previously chrome plated and now ceramic coated have seen significant life increase. Tech17 (Chrome Seal), for mud rotors, has improved down-hole life by five times.

Aerospace

As one of the first industries to fully adopt thermally sprayed treatments into the design of precision engineered components, aerospace applications have been a focus of Bodycote's thermal spray activities. With over 100 key thermally sprayed applications within aerospace turbine engines, Bodycote can provide surface technology solutions for a range of properties including wear control, corrosion resistance, thermal efficiency and conductiveness to protect against lightning strikes. Without these surface treatments, today's aircraft components would not operate to the required standards.

Pump & chemical

Dramatic results have been achieved for the pump industry, particularly in chemical applications. Pumps exposed to petrochemicals, acids, seawater, chlorides, hydrochlorics and cryogenic temperatures have experienced extended life cycles by factors of up to 100, when tested against unprotected pumps. Reciprocating piston pumps, centrifugal impeller pumps and high pressure injection pumps have benefited from Bodycote ceramic coatings.

Plastics

Pipe extruders run PVC pellets through an extruder which transforms the pellets into a molten state. Bodycote ceramics are used to coat the Y-pipe, spider, diffuser, cone and pin components. This has resulted in a significant life increase and a five-fold reduction in cleaning cycles. Chrome plated extruder screws, a key component of the injection moulding process, are treated with Tech17 (Chrome Seal), resulting in a ten times life increase over conventional chrome plate.

Printing

Rolls used within aggressive environments, such as those found in steel, paper and printing industries, suffer severe wear and corrosion problems resulting in high replacement costs, reduced performance, impaired quality and excessive downtime. With the use of high pressure high velocity oxy-fuel (HP/HVOF) thermal spraying techniques, a durable engineered surface, with high micro hardness and excellent wear and corrosion resistant properties, can be applied to the roll face and journals. This coating can be either textured or ground/superfinished, giving the required characteristics which enhances the performance of the roll and extends service life.

Steel

Bodycote ceramics have been successfully used to combat tool problems in the zinc die casting, cold forming and hot forging industries. Bodycote ceramics are also resistant to molten zinc and tin, having successfully improved the performance of correcting rolls and zinc pot rolls, used in the manufacture of galvanised steel strip. Significant improvements in life and downtime costs have been achieved. Other applications include guide bars, pump internals, and electric motor bearings.

Textile

Yarn contact components for textile machinery require extreme resistance to wear and corrosion, as well as a very low friction surface to prevent yarn damage. Bodycote ceramic coatings, on thread guides, draw rolls, air jet plates, cooling tracks, Godet rolls and yarn feeders, greatly reduce maintenance and downtime costs. The extremely fine grain structure of Bodycote ceramic produces a very smooth low friction surface (COF 0.21 – 0.26). This combination produces excellent wear properties.

Canning

Can machine manufacturers often specify Bodycote ceramic as a direct replacement for chrome plate. Extreme hardness (2850 Hv) and a low friction surface significantly improve component life and reduce product damage. Typical applications are guides, can turrets and u-bends.

Down to earth – a component journey

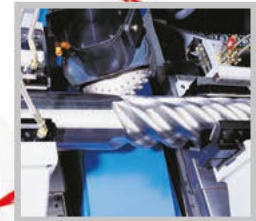
Mud rotors

Corrosion and wear can lead to expensive downtime in oil & gas exploration, where equipment is in continual use. Mud rotors operate at the bottom of drilling wells, thus, the removal and replacement of worn rotors is particularly time consuming and costly. Following processing by Bodycote, the life of mud rotors is improved significantly.



The rotors begin life as pieces of steel bar

- A thermochemically formed ceramic surface treatment is applied resulting in a super-hard, corrosion resistant layer which protects the steel and gives superior wear resistance



The steel is then machined into the rotor shape required for down-hole drilling

Photo courtesy of Weingartner www.weingartner.com



- The rotor must be finish polished using diamond tools due to the extreme hardness of the ceramic treatment



End application – oil drilling service

BODYCOTE COMPONENT JOURNEYS

This is just one example of how Bodycote brings together the huge wealth of knowledge and expertise from across the Group to provide the vital engineering services our customers need...

For more component journeys visit www.bodycote.com

■ Denotes the parts of the component journey undertaken by Bodycote

www.bodycote.com

Operating an international network of facilities and serving a wide range of industries, Bodycote is the world's largest and most respected provider of thermal processing services – a vital link in the manufacturing supply chain.

Bodycote operates in two major areas: the Aerospace, Defence & Energy business serves the aerospace, defence, power generation and oil & gas industries, whilst the Automotive & General Industrial business serves sectors including automotive, construction, tooling, medical and transportation.

Bodycote offers ceramic coatings from countries around the world:

UK
Knowsley, UK
+44 151 546 2147

USA
Hot Springs AR, USA
+1 501 760 1696
Houston TX, USA
+1 281 227 8222

UAE
Dubai, UAE
+971 4 885 1300

Singapore
Singapore, Singapore
+65 6576 9888

Bodycote plc
Springwood Court
Springwood Close
Tytherington Business Park
Macclesfield
Cheshire
United Kingdom
SK10 2XF

Tel: +44 (0)1625 505300
Fax: +44 (0)1625 505313
Email: info@bodycote.com

© Bodycote plc 2013
Ref: ID5801
Designed and produced by ID
www.interactivedimension.com