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REVOLUTIONARY COATING

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Blackstone—The Ultimate Performance Coating

Engineered for the Elite. Proven in the Field.

Since 2015, Blackstone has set the standard for high-performance coatings, trusted by OEMs, Law Enforcement, and Military for the toughest applications. Now fortified with **Graphene**, Blackstone delivers unmatched durability, reduced friction, and extreme wear resistance—ensuring superior protection in the most demanding environments.

Precision-Engineered for Every Mission:

- Blackstone DFL – Advanced dry film lubricant for friction reduction.
- Blackstone Plus – All-purpose performance coating for enhanced reliability.
- Blackstone HD – Heavy-duty protection for exterior components and extreme conditions.
- Blackstone TC – High-temperature resistance for suppressors and thermal-intensive applications.

Tested and validated to military standards, Blackstone meets MIL-STD-810G (Method 509.5) and ASTM B117 (See Exhibit B.). for corrosion and salt fog protection, ensuring performance you can trust when failure is not an option.

Blackstone—Built for Performance. Proven to Last.

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What is Graphene?

Graphene is a single layer of carbon atoms arranged in a hexagonal lattice, making it the first true two-dimensional material ever discovered. (See Exhibit A.)

Why is Graphene Called the "Wonder Material"?

- Graphene possesses extraordinary properties that set it apart from any other material:
- Strongest Material on Earth – 200 times stronger than steel.
- Thinnest Material Ever Discovered – Just one atom thick.
- Most Conductive Material – Excels in both electrical and thermal conductivity.
- Unmatched Light Absorption – Absorbs and interacts with light like no other material.
- Highly Flexible & Impermeable – Maintains strength when stretched. Repels gases & liquids.
- Ultra-Low Friction – Exhibits the lowest known coefficient of friction, reducing wear and improving efficiency.

Graphene's Game-Changing Applications:

- Biomedical – Drug delivery, biosensors, and medical imaging.
- Composites & Coatings – Enhances strength, durability, and conductivity.
- Electronics – Revolutionizing semiconductors, flexible displays, and next-gen transistors.
- Energy – Boosting battery performance, supercapacitors, and solar cells.
- Aerospace – Lightweight, ultra-strong materials for aircraft and spacecraft.

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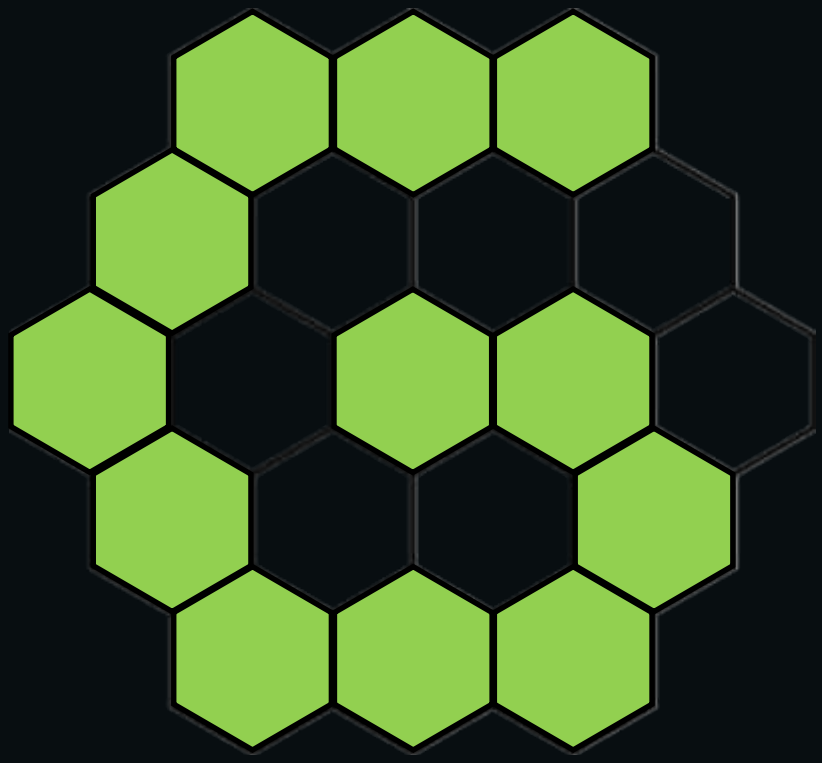

Graphene

Innovation without Boundaries

- 200x Stronger than Steel
- 1 Million Times Thinner than a Human Hair
- 1,000x Lighter than a Piece of Paper
- 346x Stronger than Kevlar
- 2 Dimensional

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Why Use Graphene in Coatings?

Unmatched Performance. Superior Protection. Game-Changing Innovation.

Graphene revolutionizes traditional coatings by enhancing durability, flexibility, and protective properties far beyond conventional materials.

Unrivaled Benefits of Graphene-Infused Coatings:

- Unmatched Corrosion Resistance – With its ultra-dense honeycomb structure, Graphene forms the most impermeable protective barrier known, shielding against humidity, salt, and environmental degradation far better than standard coatings.
- Extreme Flexibility – As the most flexible and pliable material on Earth, Graphene allows coatings to bend and conform to substrates without cracking or failing, ensuring long-term integrity.
- Ultra-Low Friction – Graphene's unique layering enables surfaces to slide effortlessly, dramatically reducing friction and wear compared to traditional coatings.
- Superior Strength & Durability – As the strongest known material, Graphene enhances coating stability, reinforcing UV resistance, longevity, and impact resistance, minimizing maintenance and failures.
- Advanced Conductivity – When incorporated into conductive coatings, Graphene provides enhanced electrical control, optimizing performance for specialized applications.
- Extreme Temperature Resistance – Designed for high-temperature environments, Graphene elevates thermal thresholds, offering superior protection against intense heat and extreme conditions.

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Organic vs. Inorganic Coatings: Understanding the Difference

Coatings play a crucial role in protecting and enhancing materials, but not all coatings are created equal. The distinction between organic and inorganic coatings lies in their composition, application, and protective properties.

What is an Organic Coating?

Organic coatings are formulated from carbon-based compounds derived from plant, animal, or synthetic sources. These coatings provide a protective and decorative finish, shielding surfaces from corrosion, oxidation, and environmental damage.

Key Features of Organic Coatings:

- Can be single-layer (monolithic) or multi-layered systems.
- Depend on chemical inertness and impermeability for protection.
- Available in a variety of forms, including primers, adhesives, enamels, varnishes, and paints.
- Versatile application methods – applied via brush, spray, roller, dip, or electrostatic means.
- Cures through solvent evaporation, polymerization, or oxidation.

What is an Inorganic Coating?

Inorganic coatings are chemically bonded to a surface through a reaction that transforms the outer metal layer into a protective oxide film or compound. These coatings are known for

their corrosion resistance and high-temperature performance. Examples of Inorganic Coatings include; surface conversion coatings, anodizing, enameling, metallic coatings, etc.

Where Does Graphene Coating Fit?

Unlike traditional inorganic coatings, Graphene coatings like Blackstone do not chemically alter the surface or change the metallurgical hardness such as QPQ. Since Graphene is just one atom thick and acts as a protective barrier rather than a chemically reactive layer, Blackstone is classified as an organic coating—offering next-generation protection, flexibility, and durability.

Cerakote vs. Blackstone: A Superior Organic Coating Comparison

Both Cerakote and Blackstone are advanced organic coatings, offering superior performance compared to traditional anodizing. Let's take a closer look at each:

Cerakote – Versatility and Color Precision

Unlike anodizing, which has limited color options and inconsistencies, Cerakote offers over 200 unique colors, all held to a strict Delta E consistency standard of 1 or less—eliminating drastic variations.

Key Advantages of Cerakote Over Anodizing:

- No Impact on Fatigue Strength – Unlike anodizing, which creates a brittle and porous oxide layer, Cerakote maintains the structural integrity of aluminum alloys.

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Why Blackstone Stands Out:

- Superior Color Retention – Available in Black, Dark Grey (Greystone), Sandstone, and Greenstone, ensuring consistent and reliable finishes without unnecessary fillers or additives.
- No Structural Weakness – Just like Cerakote, Blackstone does not impact fatigue properties, avoiding the brittle, porous layer and tensile stress issues associated with anodizing.
- Environmentally Friendly – Free of heavy metals, unlike some anodizing methods that release hazardous chemicals like hexavalent chromium.

Both Cerakote and Blackstone offer exceptional performance as organic coatings, but Blackstone's Graphene-enhanced technology takes durability, consistency, and protection to the next level.

Blackstone: The Future of Organic Coatings.

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DFL

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Blackstone DFL—Dry Film Lubricant

Blackstone DFL is a high-performance PTFE-based industrial coating formulated by Innovative Aspects for exceptional dry lubrication and corrosion resistance. This product utilizes Teflon™ in a one-coat process, designed to be applied in a single layer that cures into a tough, durable film. Blackstone DFL creates a smooth, low-friction surface (a bonded dry-film lubricant) that reduces wear and prevents galling of metal parts.

It also provides outstanding salt spray corrosion resistance, protecting components against rust in harsh environments.

The coating is black in color (approx. RAL 9011) and capable of continuous operation at temperatures up to 260 °C (500 °F) before Graphene fortification, making it suitable for a wide range of demanding applications.

Key Features & Benefits

- Dry Lubrication & Low Friction: Forms a slick PTFE film that reduces friction and wear. This dry lubricant finish prevents galling and seizing of mating parts, especially in conditions where reapplication of oil or grease is impractical (e.g., in dusty environments or sealed assemblies). The result is smoother operation and extended part life without the need for liquid lubricants.
- Corrosion & Salt Spray Resistance: Provides excellent resistance to corrosion, verified by strong salt-spray test performance. The coating acts as a protective barrier against moisture and chemicals, preventing rust on steel substrates and offering reliable corrosion protection even in marine or chemically harsh environments.
- Tough & Durable Film: Cures to a hard, abrasion-resistant film that stands up well to me-

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chanical stress and wear. It maintains its integrity under friction and repeated use, ensuring long-lasting protection. (For applications requiring maximum abrasion resistance, a sisterproduct Blackstone Plus incorporates additional fillers to further enhance durability.)

- High Temperature Performance: Engineered for high-heat applications, it remains effective at continuous operating temperatures up to 260 °C (500 °F) before Graphene fortification. The coating will tolerate brief excursions above this, and while its color may turn brownish at higher bake temperatures, its performance and lubricity are not affected by the color change.
- Thin, One-Coat Application: Designed as a single-coat system applied at a dry film thickness of only ~15–20 µm (0.6–0.8 mils). Even in one thin layer it achieves full performance, eliminating the need for a primer or multiple coats. This saves application time and preserves tight tolerances on precision parts. (Multiple coats are not recommended, as one coat provides optimal results.)
- Flexible Cure Requirements: While a high-temperature cure of 343 °C (650 °F) for 15 minutes is recommended for best hardness, the formulation allows curing at lower temperatures if needed. In fact, with extended bake times, it can be cured at temperatures as low as ~177 °C (350 °F) in situations where the substrate cannot manage 650 °F. This low-cure capability makes Blackstone DFL more versatile than many similar coatings and broadens the range of parts that can be coated (with only a slight trade-off in ultimate film toughness at lower cure).
- Excellent Adhesion: Formulated with a special binder, Blackstone DFL exhibits strong adhesion to properly prepared metal surfaces. It bonds tenaciously to steel, stainless steel, aluminum, and other alloys after surface roughening, ensuring the coating will not flake or chip under thermal cycling or stress.

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Technical Specifications before Graphene fortification

- Color & Type: Black, one-coat PTFE coating with a binder (solvent-based liquid).
- Viscosity: 200 – 870 cP @ 25 °C (Brookfield RVT).
- Solids Content: ~16.6–17.6% by volume (24.6–28.6% by weight). Produces a thin dry film (~15 µm) from each coat.
- Density: ~1.06 kg/L (8.8 lb/gal).
- VOC Content: ~734 g/kg (European method) – equivalent to ~6.4 lb/gal VOC (high solvent content).
- Maximum Use Temperature: 260 °C (500 °F) continuous operating temperature.
- Cure Schedule: 15 minutes @ 343 °C (650 °F) metal temperature for full cure. (Can be cured at lower temperatures down to ~177 °C with extended cure time, if needed.)

Recommended Applications & Industries

Steel studs coated with a PTFE-based dry-film lubricant to prevent corrosion and reduce friction. Blackstone DFL is used across many industries that demand reliable, long-lasting lubrication and corrosion protection. Its unique combination of properties makes it suitable for a variety of applications:

- Automotive & Transportation: Used on engine pistons (skirt coatings), valve components, springs, bushings, and other moving parts to reduce friction and wear. Also applied to drivetrain and under-hood parts (e.g., hinge pins, latches) to provide maintenance-free lubrication. Many automotive components benefit from their ability to withstand high heat and loads.

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- Industrial Machinery: Ideal for sliding machine elements such as guide rails, tracks, cams, and hinges, as well as bearings, gears, and cutting blades. The dry-film lubricant prevents metal-on-metal contact, reducing frictional losses and preventing galling in industrial equipment. Components like slide gates, knives, and springs in machinery remain operable without grease thanks to the self-lubricating film.
- Hardware & Fasteners: Often applied to bolts, studs, nuts, and hardware that are exposed to harsh conditions. The coating's excellent salt spray resistance means coated fasteners will not rust or seize, even in marine or outdoor environments. This makes it valuable for offshore equipment, construction fittings, and any metal parts that must endure weather or corrosive chemicals while moving freely.
- Chemical Processing Equipment: Thanks to its chemical integrity and corrosion protection, Blackstone DFL is used on parts like pump impellers, valve components, mixers, and tank hardware in chemical and petrochemical industries. It provides a protective, low-friction barrier that can manage aggressive chemicals and solvents, improving the lifespan of process machinery (e.g., pumps, valves, agitators) while preventing metal parts from sticking or corroding.
- Consumer Goods & Outdoor Equipment: Employed on lawn and garden tools, hinges, and firearm components – anywhere a durable, friction-reducing finish is beneficial. It can give outdoor equipment (springs, latch mechanisms, etc.) long-term lubrication that will not wash off in rain or attract dirt. Many general industrial and consumer products use this coating to add a premium, long-lasting nonstick surface.

Environmental & Safety Considerations

- PFOA-Free Formulation: Blackstone DFL is made without PFOA (perfluorooctanoic acid).

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The manufacturing process has been refined to eliminate PFOA, aligning with global regulatory standards on PFAS chemicals. This means Blackstone Plus does not use PFOA as a processing aid and is compliant with modern environmental and safety guidelines for fluoropolymer products.

- Not Food-Contact Safe: This product is not intended for direct food contact applications. Blackstone DFL and its variant Blackstone Plus do not comply with FDA regulations governing food-contact coatings, so they should not be used on cookware or surfaces that touch food products. (Innovative Aspects offers other food-grade Teflon™ coatings for those purposes.)

Comparison & Positioning

Blackstone DFL is distinguished by its balance of excellent lubricity and good general durability. In comparative terms, Blackstone DFL offers the lowest friction (most “slick”) film among its peers, making it ideal for maximum lubrication in applications where smooth motion is critical. The trade-off is that its abrasion resistance, while particularly good, is not the absolute highest – for situations where extreme wear or harsh abrasion is expected, Innovative Aspects formulated Blackstone Plus as a companion product with additional fillers. The Blackstone Plus coating is also black and shares the same 0.8 mil thickness limit and 260 °C use temperature, but it delivers “better” durability at the cost of slightly reduced lubricity. In other words, Blackstone DFL is the go-to choice for maximum PTFE slickness, whereas Blackstone Plus is chosen when a bit more toughness is needed (for example, on parts that see constant sliding contact or abrasion). Both are one-coat systems and are often used together in a coating portfolio depending on the part requirements.

DFL

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Innovative Aspects also offers Blackstone HD, which is a thicker-film one-coat dry lubricants (capable of up to ~4 mils DFT) with even more robust abrasion resistance. Those thicker coatings sacrifice some operating temperature (rated to ~400 °F) and a bit of lubricity for maximum durability in heavy-duty applications. By contrast, Blackstone DFL's thin application and 500 °F heat tolerance positions it as an optimal solution for lightweight, high-precision components and high-temperature uses where a single, thin coat must provide both lubrication and corrosion protection.

In the broader market of industrial coatings, Blackstone DFL competes with other dry-film lubricant coatings (such as Whitford Xylan® and Henkel Emralon® series, among others) which are used for similar purposes. It distinguishes itself through Graphene fortification and proven PTFE technology and lower curing temperature. Many comparable PTFE-based coatings require extremely high cure temperatures or multi-layer application; by offering a one-coat, 343 °C cure system, Blackstone DFL can be applied to a wider range of parts (including some heat-sensitive alloys) and with simpler processing. Users also benefit from Innovative Aspects' technical support and standardized quality. In summary, Blackstone DFL is positioned as a versatile, industry-proven coating that provides a combination of dry lubrication, corrosion resistance, and ease of application that is hard to beat, making it a popular choice for manufacturers looking to enhance the performance and longevity of their metal components.

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Blackstone Plus—Superior Performance

Blackstone Plus is a premium solvent-based PTFE one-coat designed to create a tough, durable film that provides permanent dry lubrication. It excels in harsh conditions with excellent salt-spray corrosion resistance and is formulated for exceptional abrasion resistance (notably higher than the Blackstone DFL variant). This black, PTFE-infused coating offers a smooth, slick finish that strongly bonds to metal surfaces, dramatically reducing friction, galling, and seizing of components. Because it lubricates without oils or grease, it will not attract dirt or dust – ideal for environments where re-lubrication is impractical, or contamination is a concern. In short, Blackstone Plus combines the famed nonstick and low-friction properties of Teflon™ with reinforced durability, making it a go-to solution for long-lasting equipment protection.

Key Features & Benefits

- Permanent Dry Lubrication: Provides an extremely low coefficient of friction for moving parts, eliminating the need for oils or greases. This prevents sticking and ensures smooth motion even under heavy loads, solving design problems related to wear, noise, or parts binding. The coating's PTFE content yields a slick, non-stick surface that also resists buildup of debris or deposits.
- Corrosion & Salt Spray Resistance: Formulated to withstand corrosive environments, it acts as a barrier against rust and chemical attack. Blackstone Plus performs reliably in salt spray conditions (marine or road salt exposure) – preserving metal substrates far longer than uncoated steel. This makes it ideal for coastal, marine, or chemically harsh settings where ordinary coatings would deteriorate.
- Enhanced Abrasion Resistance: Engineered with specialized fillers and a tough binder, Blackstone Plus stands up to repeated friction, impact, and wear. It outperforms standard

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dry film lubricants (like Blackstone DFL) in high wear conditions, extending the service life of coated components. Even with constant sliding or rubbing contact, the coating maintains its integrity, protecting the underlying metal.

- Thin, Durable Film: Applies as a thin layer (~15–20 µm) that fuses tightly to the substrate. Despite its slim profile, the one-coat system has strong adhesion (thanks to a robust binder) and will not flake or chip under stress. This thin film nature means it does not significantly alter part dimensions or clearances, which is important for precision components.
- High Temperature Stability: Capable of continuous operation up to 260 °C (500 °F) before Graphene fortification without losing properties. The coating endures wide temperature swings – from sub-zero to heat – making it suitable for engine and machinery parts that see high heat. (For comparison, these PTFE one-coats have the highest operating temperature of common fluoropolymer coatings.) Even at extreme temperatures, the film remains intact and effective.
- Chemical Resistance: Like all Teflon™ coatings, Blackstone Plus is chemically inert to most substances, resisting solvents, fuels, oils, and many chemicals. It protects parts from chemical corrosion and can even provide a release effect (nonstick) against adhesives or resins. This broad resistance means the coating survives in chemically aggressive environments where other lubricants might break down.
- One-Coat Convenience: Requires only a single coat application with no primer, simplifying the finishing process. This saves time and reduces process complexity while still delivering high performance. The one-coat system also enables easier touch-ups or re-coating compared to multi-layer systems. (Flexible curing options even allow lower bake temperatures when needed, as described below.)
- Stable Cosmetic Appearance: Comes in black (RAL 9011) for a sleek, uniform look. The

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cured film is matte black; if baked at the upper end of cure temperature, the color may shift to a brownish tint, but performance is not affected. This ensures that cosmetic changes at high bake or service temperatures will not signal any loss of protection or functionality.

Technical Specifications before Graphene fortification

- Color: Black (near RAL 9011)
- Composition: PTFE fluoropolymer in a resin matrix (one-coat, solvent-based). Blackstone Plus includes proprietary fillers to boost wear resistance.
- Viscosity: ~500–900 cP (Brookfield RVT, 20 RPM @25 °C) – a sprayable liquid coating. (Blackstone Plus is slightly more viscous than 958G-303, which is ~200–870 cP.)
- Solids Content: ~19.9–20.9% by volume (~25.5–29.5% by weight). This higher solid percentage allows good coverage (~7.5 m²/kg at 25 µm dry film) and contributes to its robust film build.
- Density: ~1.09 g/mL (9.1 lbs/gal) in liquid form.
- VOC Content: ~690 g/kg (European method). As a solvent-based coating with significant VOC, it requires appropriate ventilation during application (see safety notes). US regulatory VOC information is available on the SDS.
- Maximum Use Temperature: 260 °C (500 °F) continuous. The coating maintains lubrication and integrity up to this temperature. Intermittent spikes above 260 °C may cause slight decomposition (common to PTFE) if very prolonged, but in normal use it is extremely stable.
- Recommended Film Thickness: 15–20 µm dry (0.6–0.8 mils) per coat. A single coat at this thickness is optimal; applying multiple layers is not recommended for this product.

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- Cure Requirement: 15 minutes at 343 °C (650 °F) metal temperature for full cure. This high-temperature bake fuses the coating to the substrate. Notably, it can be cured at lower temperatures (as low as ~250 °C/480 °F) if the bake time is extended, although doing so may slightly reduce ultimate hardness and durability. This flexibility can be useful for heat-sensitive parts, though 343 °C is recommended for best performance.

Recommended Applications & Industries

Blackstone Plus is used across a wide range of industries to solve friction, wear, and corrosion challenges. Some common applications and sectors include:

- Automotive & Transportation: Employed extensively in vehicles – from cars and motorcycles to buses, trucks, and heavy equipment. Parts like door hinge pins, latches, springs, seat belt components, throttle shafts, and piston skirts benefit from the dry-film lubrication and noise reduction this coating provides. It meets the automotive industry's demanding needs for coatings that withstand constant vibration, abrasion, salt spray, and high under-hood temperatures while reducing wear and noise (NVH). Tier-1 suppliers coat parts such as brake shims, clips, fasteners, and engine components with Blackstone Plus to ensure long-term reliability without maintenance lubrication.
- Heavy Machinery & Industrial Equipment: Ideal for equipment that faces high friction and harsh conditions. Examples include slide gates and valves (to prevent seizure and galling), guide rails and tracks (for smooth movement), industrial blades or cutters (to reduce material sticking and friction), and bearings or bushings that need a dry lubricant backup. In construction, mining, and agricultural machinery, Blackstone Plus protects pivot points and moving joints from dust intrusion and wear. It effectively extends the life of components in conveyors, hydraulic systems, compressors (e.g., compressor pistons), and pumps, espe-

cially where oil/grease lubrication is impractical.

- Marine & Offshore Hardware: Thanks to its superb saltwater corrosion resistance, this coating is well suited for marine hardware, ship components, and offshore equipment. Hinges, locks, fasteners, and pulley components on ships or oil rigs can be coated to prevent rust in salt air while ensuring they operate freely. Blackstone Plus's dry lubrication will not wash away or attract sand, making it excellent for marine valves, deck machinery, and diving equipment that see continuous exposure to water. (Its black finish also provides a degree of UV and weather resistance for top-side applications.)
- General Industry & Consumer Products: The coating finds use in tools and mechanical parts that demand long-lasting lubrication: e.g., garden shear blades, power tool gears, springs, and clamps, and even firearm components like slides or trigger parts. It is often applied to fasteners, nuts, and bolts to enable consistent torque and easy disassembly after exposure to the elements. In the aerospace sector, parts with tight tolerances such as actuators and hinge pins are coated with PTFE dry lube coatings to reduce wear. Any metal part that needs a durable, low-friction, non-stick surface and corrosion protection can be a candidate for Blackstone Plus.

(Note: While Blackstone Plus provides many benefits, it is not intended for direct food-contact applications, so it is used on food processing equipment framework or tooling rather than on surfaces that touch edible products.)

Environmental and Safety Notes

When using and specifying Blackstone Plus, it is important to consider environmental, health, and safety aspects:

- PFOA-Free Formulation: Blackstone Plus is made without PFOA (perfluorooctanoic acid).

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The manufacturing process has been refined to eliminate PFOA, aligning with global regulatory standards on PFAS chemicals. This means Blackstone Plus does not use PFOA as a processing aid and is compliant with modern environmental and safety guidelines for fluoropolymer products.

- Food Contact & Regulatory Status: This coating is not approved for direct food contact. Both Blackstone DFL and Blackstone Plus do not comply with FDA food-contact regulations governing coatings in contact with food. They are intended for industrial use. If a food-safe nonstick coating is needed, other specific food-grade formulations should be used. Always verify compliance with any industry-specific regulations (for example, automotive or aerospace specifications) when using the coating in those fields.

Comparison: Blackstone Plus vs Blackstone DFL (and Other Coatings)

Blackstone Plus is part of a family of one-coat dry film lubricants, and it is helpful to understand how it stacks up against its closest sibling (Blackstone DFL) and other similar coatings:

- Blackstone DFL Dry Lube (Standard PTFE One-Coat): Blackstone DFL is a remarkably similar black PTFE one-coat, and it served as the baseline for dry-film lubrication. Both Blackstone DFL and Blackstone Plus provide solid dry lubrication and corrosion protection up to 260 °C before Graphene fortification. The key difference is abrasion resistance – Blackstone DFL does not contain the additional fillers that Blackstone Plus has, so its durability under wear is lower. In practice, Blackstone DFL offers slightly higher initial lubricity (often noted as "excellent" friction reduction) thanks to its pure PTFE makeup, but its wear life is shorter (rated "good" durability). Meanwhile, Blackstone Plus's lubricity is still incredibly good (more than sufficient for most uses), and it trades a barely perceptible increase in friction for a significant boost in abrasion resistance ("better" durability). In technical terms, Black-

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stone DFL has a bit lower volume solid (~16–17% vs ~20% in 313) and a higher VOC content (~734 g/kg vs 690). Both cure at the same conditions and have the same max temperature rating. Use Blackstone DFL for applications where ultra-low friction is the top priority and wear is less aggressive; use Blackstone Plus for applications where added wear resistance is needed in addition to dry lubrication. Often, Blackstone Plus will be the preferred choice for most heavy-duty needs, given its more robust performance in demanding environments.

- Other Blackstone One-Coat Dry Lubricants: Blackstone offers other one-coat formulations in this category. Blackstone HD is also PTFE-based dry film lubricants with enhanced abrasion resistance. Like Blackstone Plus, it incorporates fillers to improve durability. Blackstone HD is a black one-coat that can be applied thicker (up to ~4 mils) and is often used when a heavier film build or slightly textured finish is acceptable; it has a lower maximum operating temperature (~204 °C/400 °F) before Graphene fortification and similar wear performance to Blackstone Plus. Within the Blackstone family, Blackstone DFL< Blackstone Plus < Blackstone HD can be seen as a trade-off spectrum: from highest slickness/lowest wear to incredibly good slickness/higher wear, to moderate slickness/remarkably high wear resistance. All are applied similarly (one-coat spray and bake), and all provide dry lubrication and corrosion protection – the choice depends on the specific balance of properties required.
- Competing Coating Solutions: In the broader market, there are other dry-film lubricant coatings (often PTFE or molybdenum-disulfide based) from various brands. Blackstone Plus is positioned as a premium option combining PTFE's low friction with a binder that gives it exceptional toughness. Compared to generic fluoropolymer coatings or older MoS_2/graphite lacquers, Blackstone Plus generally offers a more versatile performance: it manages higher temperatures and loads, resists corrosion better, and has a more robust film that

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does not require frequent reapplication. Its one-coat application and curing flexibility also make it efficient for industrial applicants. Clients looking at alternatives will find that Blackstone Plus's unique mix of dry lubrication + durability often allows it to replace multi-coat systems or thicker sacrificial lubricants, providing a longer-lasting solution in one layer. And of course, it carries the well-known brand assurance of quality and consistency.

In summary, Blackstone Plus stands out as an abrasion-resistant, dry lubricant coating that marries the low-friction, nonstick qualities of PTFE with a tough, industrial-grade binder system. It protects critical components in automotive, heavy industrial, and marine applications – reducing wear, preventing corrosion, and eliminating the need for traditional lubrication. With its proven performance (backed by Chemours' expertise and data), Blackstone Plus is an excellent choice for engineers and end-users seeking a high-performance industrial coating that delivers both lubricity and longevity in demanding environments.

HD

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Blackstone HD—Heavy Duty

Blackstone HD is a specialized industrial coating from Innovative Aspects designed as a low-bake, PTFE-based one-coat system. It cures at low temperatures to form a hard, dry lubricating film with outstanding adhesion, wear resistance, and corrosion protection. This coating provides the signature low friction of PTFE (Teflon™) in a convenient single-coat application, making it ideal for reducing friction and preventing wear on metal parts without the need for additional lubricants.

Key Features & Benefits

- Low-Temperature Cure ("Low Bake"): Cures at much lower temperatures (~180°C/356°F) than traditional PTFE coatings, saving energy and allowing use on parts that cannot withstand extreme heat. (An optional higher cure at 225°C can be used to achieve even greater hardness.) This flexible cure window (as low as 350°F) makes the coating accessible to a broader range of applications.
- PTFE-Based Dry Lubrication: Formulated with PTFE for a slick, non-stick surface, and incredibly low coefficient of friction. It creates a smooth, dry lubricating film that minimizes friction, galling, and seizing of mating parts. The dry film will not attract dust/debris like oils do, making it great for dirty or abrasive environments.
- Wear & Abrasion Resistance: Despite being PTFE-rich, Blackstone HD cures into a hard, durable coating that resists scratching, abrasion, and mechanical wear. It adheres strongly to the substrate, so it can manage friction and repeated use without chipping or peeling.
- Corrosion Protection: Provides a robust barrier against moisture and chemicals, offering good corrosion resistance (e.g., holds up well in salt spray tests). This helps protect metal

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HD

components from rust and chemical attack while the PTFE ensures they remain free of movement.

- One-Coat Convenience: Applied in a single coat without the need for a primer or multiple layers. This simplifies the application process and reduces production time. The coating can be built up in multiple passes if needed and even over-coated or lightly machined after curing for fine tolerances.
- Thin, Non-Building Film: Forms an ultra-thin dry film (typically ~25–40 µm per coat) that bonds tightly to the surface. The thin profile means it will not significantly alter part dimensions or clearances – great for tight tolerance parts. A special thin film variant (Blackstone DFL) exists in the same product family for even lower film build needs.
- Enhanced Equipment Performance: By reducing friction and the need for grease, it keeps equipment running smoother and cleaner. It prevents metal-on-metal contact, reducing squeaks and wear, which can extend the service life of components and improve reliability.

Technical Specifications before Graphene fortification

- Type: Solvent-based PTFE-reinforced one-coat (liquid spray coating). Contains a blend of PTFE and hardeners/binders that fuse during curing into a tough, inert film.
- Color: Black (when cured). Wet products appear black and correspond to RAL 9011 for color matching.
- Viscosity: ~1,400 – 2,300 cP at application (Brookfield RVT, 25 °C) – a sprayable liquid coating.
- Solids Content: ~17% by volume (≈22–25% by weight). This moderate solid content yields thin, even films and good coverage (~6.4 m^2/kg at 25 µm DFT).

HD

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- Density: ~1.08 g/mL (≈9.0 lbs/gal)in the liquid form.
- VOC Content: High – approximately 769 g/L (European method). As a solvent-rich coating, it will emit VOCs during curing, necessitating proper ventilation or abatement.
- Cure Cycle: Multi-step low-temperature bake. After application, a brief drying stage of ~5–10 minutes at 60–80 °C is used to evaporate solvents. Then a two-stage bake: ~20 minutes at 80–100 °C, followed by ~60 minutes at 150 °C, and a final cure of 60 minutes at 180 °C (356 °F) for full polymerization. (Optionally, for a harder cure, the final stage can be 15 minutes at 225 °C (437 °F).) This low max cure temperature is a key advantage of Blackstone HD.
- Operating Temperature: Up to 200 °C (392 °F) continuous use before Graphene fortification. The cured coating retains its lubricity and integrity in a wide temperature range from sub-zero up to around 200 °C.
- Hardness: Cures to a hard film capable of withstanding significant abrasion. While an exact hardness value (e.g., on a scale) is not given, the product is noted for its durability under friction.
- Adhesion: Excellent adhesion to properly prepared metal substrates. The one-coat system is engineered to bond tenaciously, preventing under film corrosion or flaking.
- Chemical Resistance: Resistant to many chemicals, oils, and solvents. The PTFE component is chemically inert, and the binder provides a protective barrier, giving the coating good resistance to corrosive agents (as evidenced by strong salt-spray performance).

Recommended Applications & Industries

Blackstone HD is used across numerous industries to enhance part performance and longevi-

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ty. Its combination of dry lubrication and durability makes it useful wherever moving parts need protection without the mess of oils or greases:

- Industrial Machinery & Equipment: Bearings, bushings, gears, cams, slides, and other moving machine components benefit from Blackstone HD's low friction and wear resistance. It prevents metal-to-metal contact and galling in equipment, even in dusty or dirty conditions where relubrication is impractical. This is valuable for manufacturing equipment, packaging machines, conveyors, and textile machinery where a long-lasting dry lubricant is desired.
- Fasteners & Hardware: Bolts, screws, nuts, and threaded inserts are often coated with PTFE dry-film lubricants to prevent seizure and corrosion. Blackstone HD provides a consistent, low-friction surface on fasteners, which ensures controlled torque during assembly and easy removal later. It also acts as a barrier against rust on hardware exposed to the elements.
- Automotive & Transportation: Many automotive components can be PTFE-coated to reduce wear and noise – for example, door hinge pins, latches, springs, linkage joints, and engine or transmission parts that experience friction. Blackstone HD's 200 °C heat tolerance covers under-hood temperatures for many applications, and its thin profile will not interfere with part fit. The coating's durability and chemical resistance suit it for undercarriage parts, throttle components, or fuel system parts that see both friction and exposure to fuels/fluids. (It is also used in aerospace on actuator parts, shafts, and fasteners where a reliable dry lubricant is critical, and fluid lubricants would be impractical.)
- Molds, Dies & Tools: The nonstick quality of PTFE combined with the toughness of this coating makes it useful for mold surfaces, extrusion dies, blades, and cutting tools. For example, plastic or rubber mold tooling coated with Blackstone HD can experience easier part release and less build-up on the tooling, while also resisting scratches. Cutting tools

and saw blades can have reduced friction and heat generation.

- Oil & Gas / Chemical Processing: Valves, pumps, and couplings in chemical or oilfield service can be coated to reduce friction and provide a measure of chemical resistance. The coating's corrosion protection helps parts withstand harsh environments (for instance, downhole tools or marine fittings that see salt spray).
- General Industrial Uses: Any application requiring a dry, clean, and durable lubricating film is a viable candidate. This includes hinges, pins, slides, bushings, or wear plates in agricultural machinery, construction equipment, or heavy machinery. Because Blackstone HD does not transfer or flake easily once cured, it is also suitable for mechanisms in electronics or precision devices (e.g., printer parts, robotics) where oil migration would be problematic.

(Note: Blackstone HD is not certified for direct food contact. It should not be used on surfaces in direct contact with food unless specifically approved. For food-grade applications, Innovative Aspects offers other FDA-compliant coatings.)

Environmental & Safety Considerations

When using Blackstone HD, it is important to adhere to safety and environmental guidelines, as with any industrial coating:

- PFOA-Free Formulation: Blackstone DFL is made without PFOA (perfluorooctanoic acid). The manufacturing process has been refined to eliminate PFOA, aligning with global regulatory standards on PFAS chemicals. This means Blackstone Plus does not use PFOA as a processing aid and is compliant with modern environmental and safety guidelines for fluoropolymer products.

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- Not for Food Contact: Do not use Blackstone HD on surfaces that will have direct contact with food. While Teflon™ is often associated with nonstick cookware, industrial grades like Blackstone HD are not food-safe coatings. For any food processing or pharmaceutical equipment, consult by following these guidelines, applicators can ensure a safe working environment and minimize environmental impact. Always refer to Innovative Aspects' official documentation and Safety Data Sheets for the most accurate and detailed EHS information.

Comparison with Other Blackstone Coatings

Innovative Aspects offers a range of Blackstone one-coat industrial coatings. Here's how Blackstone HD compares two other popular products in the line:

- Versus Blackstone Plus: Blackstone Plus is an earlier PTFE one-coat formulation known for its exceptional abrasion resistance. Like Blackstone HD, it is a black, PTFE-lubricated coating for dry film lubrication. The key differences are in temperature and curing: Blackstone Plus can manage higher operating temperatures (up to 260 °C / 500 °F), making it suitable for higher-heat applications. However, it requires a much higher curing temperature to fully sinter the PTFE – its process typically involves bakes up to ~350 °C (660 °F) as indicated by its test method. This means Blackstone Plus is not a "low bake" system; it needs an oven capable of near-400 °C to cure properly. By contrast, Blackstone HD achieved its properties at 180 °C. In summary, Blackstone Plus offers higher heat resistance and slightly better wear in extreme conditions, but Blackstone HD is easier to apply for most coaters due to the low bake. If your project involves temperatures well above 200 °C or demands the utmost abrasion durability, Blackstone Plus might be chosen – otherwise, Blackstone HD often provides equal performance with a simpler process. Both provide excellent corrosion protection; Blackstone Plus was noted for "excellent salt spray resistance"

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as well, comparable to Blackstone HD's corrosion performance. Keep in mind that Blackstone Plus may discolor (turn a brownish cast) when baked at the high end of its cure range, though this does not affect performance.

In summary, Blackstone HD hits a sweet spot in the Blackstone industrial coatings lineup: it offers robust performance (dry lubrication, wear, and corrosion resistance) while curing at unusually low temperatures for a PTFE-based coating. Compared to higher-temp coatings like Blackstone Plus, it is easier to apply; This makes Blackstone HD a popular choice for many OEMs looking to improve part performance with a trusted Blackstone solution.

TC

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Blackstone TC—High Temperature Ceramic Coating

Blackstone TC – is a high-temperature ceramic coating engineered to protect and enhance components under extreme conditions. This oven-cure, semi-gloss ceramic finish provides exceptional heat resistance, durability, and corrosion protection, all while improving the performance and look of your parts. Informed but non-technical readers will appreciate how Blackstone TC combines thermal management with a tough protective layer, making it ideal for applications from automotive engines to aerospace hardware. Below is an educational overview of its key features, specifications, applications, application process, safety, and a comparison to similar high-temp coatings.

Key Performance Features & Benefits

- Extreme Thermal Resistance: Formulated to endure temperatures up to 1,800°F before Graphene fortification without degrading. Blackstone TC maintains its color and finishes to 900°F (482°C) with minimal change, meaning parts stay protected and presentable even at red-hot temperatures. This high heat tolerance outperforms typical paints or powder coats, enabling use on components like exhaust systems and engines that see intense heat.
- Heat Dissipation Technology: Unlike conventional coatings that merely withstand heat, Blackstone TC actively dissipates heat. Its special sub-micron formulation transfers thermal energy away from the substrate, helping components run cooler. In testing, Blackstone TC improved heat transfer by 10–15% compared to uncoated metal. This means radiators, intercoolers, and engine parts coated with Blackstone TC can operate more efficiently, potentially extending their lifespan and performance by reducing heat buildup.
- Durable & Hard Finish: Blackston TC creates an extremely robust surface. It achieves a 7H pencil hardness (gouge) on ASTM tests – indicating excellent scratch and wear resistance –

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and a 6H scratch hardness. This hard ceramic finish resists abrasion, erosion from particles, and general wear and tear. It also boasts the highest impact resistance rating (160 inch-lbs direct impact with no cracking or chipping), so it can withstand gravel strikes or drop impacts without flaking. The coating's toughness ensures long-term durability in harsh environments (off-road, industrial, etc.).

- Superior Adhesion & Flexibility: Engineered to stay firmly bonded, Blackstone TC achieves a perfect 5B adhesion score (cross-cut tape test)– the maximum, indicating the coating will not peel or flake when properly applied. Additionally, it passes a 100% conical mandrel bend with no cracking, demonstrating excellent flexibility. This combination means the coating can manage vibration, thermal expansion, and flexing of the substrate (for example, thin metal or alloys that expand when heated) without losing adhesion or integrity.
- Corrosion & Chemical Resistance: Blackstone TC provides strong protection against rust and chemical exposure. Its advanced ceramic-resin formula seals the surface, guarding metal from moisture and salts that cause corrosion. In fact, Blackstone TC is formulated to protect metal from corrosion and solvent exposure, offering maximum chemical and solvent resistance. This makes it ideal for harsh environments – from road salt on automotive parts to cleaners and oils in industrial settings. Components stay rust-free and stain-free, reducing maintenance and extending part life.
- Solid Film Lubricant Properties: Uniquely, Blackstone TC doubles as a dry film lubricant. It meets military specification MIL-L-46010E for solid film lubricating coatings, meaning it can reduce friction between moving parts. The coating's micro-particles create a low-friction surface that prevents galling and seizing metal-on-metal contact. This lubricious benefit is especially useful for firearms internals or engine components – providing smoother operation and less wear without needing traditional oil. Blackstone TC not only protects surfaces but also helps them move more freely.

TC

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- Enhanced Aesthetics & Color Stability: Blackstone TC cures to a semi-gloss black finish that is both functional and attractive. The smooth satin sheen gives parts a professional look without a high-gloss glare. Importantly, this coating is designed for color stability – it retains its deep black appearance without significant fading, even under prolonged heating (no noticeable color change until above ~900°F). Unlike ordinary high-temp paints that are often dull, chalk, or discolor (e.g., turning gray or white) at lower temperatures, Blackstone Blackstone TC stays uniform and good-looking in service. This aesthetic protection is valuable for visible components like engine covers or exhaust manifolds, keeping them looking fresh and clean over time.
- Thin, Lightweight Coverage: A little goes a long way – Blackstone TC is applied at only 0.25 to 0.50 mil thickness (a few microns). This ultra-thin coating adds negligible weight and does not alter part dimensions significantly. Because it is so thin, it will not interfere with tight tolerances or assembly. You get full protection and performance benefits without bulky buildup. The coating is also low-density (0.83 g/mL), contributing minimal mass. This is critical for aerospace or high-performance automotive uses where weight and fit are important.
- Electrical Conductivity: Unlike many ceramic coatings which are insulators, Blackstone TC is formulated to be electrically conductive. This is a key benefit for electronic housing or any application where grounding or electrical continuity is needed. Coating a heat sink or electronic enclosure with Blackstone TC will not insulate the component – instead, it dissipates heat and still allows grounding connections. This unique feature sets Blackstone TC apart from typical high-temp finishes, making it suitable for electronics and lighting industries where both heat management and electrical conductivity are factors.

TC

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Technical Specifications before Graphene fortification

Here are the key technical specifications of Blackstone TC (Blackstone TC), as documented in official product data:

- Max Temperature (Coating Stability): 1,800 °F – Coating remains stable up to this temperature (≈982 °C)without failure.
- Color Stability: 900 °F – No significant color change or gloss loss up to this temp (beyond that, slight dulling may occur).
- Finish & Gloss: Semi-gloss black, satin sheen. (Gloss measured at 60°; actual gloss may vary with application.)
- Recommended Thickness: 0.25–0.50 mil (thousandths of an inch)– extremely thin, ensuring light weight and no fit issues.
- Hardness: 7H pencil hardness (ASTM D3363, gouge)– extremely hard ceramic surface; 6H scratch hardness. (9H is highest on pencil scale, so 7H indicates excellent scratch resistance.)
- Adhesion: 5B (ASTM D3359 Cross-cut Tape)– maximum rating; the coating tightly bonds to the substrate (no flaking or peeling in tests).
- Flexibility: 100% pass (ASTM D522 Conical Mandrel Bend)– shows no cracks when bent around a mandrel, indicating high flexibility.
- Impact Resistance: 160/160 inch-lbs (direct/indirect, ASTM D2794)– highest impact rating in both direct and reverse impact, meaning the coating absorbs shocks without damage.
- Density: 0.83 g/mL– a lightweight formulation. (For reference, water is 1.0 g/mL; Blackstone TC is lighter.)
- Solids Content: ~80% weight solids (theoretical)– a high-solids coating, yielding great cov-

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erage and minimal shrinkage.

- Chem/Solvent Resistance: Rated Excellent – Blackstone TC shows minimal color change (ΔE < 2.5) after chemical exposure, indicating outstanding resistance to chemicals (fuels, solvents, cleaners). It also resists solvents and oils without softening.
- Corrosion Resistance: Evaluated to withstand extensive salt spray (ASTM B117) – results pending/on par with other Blackstone finishes (which often exceed 1,000+ hours salt fog with no corrosion). In practice, Blackstone TC's corrosion inhibitors protect base metal exceptionally well, even in marine or road salt environments.
- Cure Schedule: Oven cure at 300 °F for 1 hour. (After application, parts are baked at 300 °F/149 °C for 60 minutes to fully cure the coating. Some documentation also allows 350 °F for 1 hour– always follow the latest product guidelines.)
- Viscosity: ~10 cP (centipoise)– a low-viscosity liquid, which sprays easily through fine nozzles.
- VOC Content: Low to No VOC – Blackstone TC is EPA VOC-compliant with extremely low volatile organic compound content. This means Blackstone TC meets environmental regulations for solvent emissions and is safer for users (less fumes than many paints). (Exact VOC level is available via SDS, but it is formulated to be within compliance in all 50 states.)
- Compliance & Standards: Meets MIL-L-46010E (a military spec for dry film lubricating coatings), underscoring its lubrication and durability credentials. Also meets stringent industry tests for high-temp coatings. Blackstone TC is RoHS compliant and EPA compliant for VOC and carries the typical ceramic coating caution for California Prop 65 (contains chemicals known to CA to cause cancer– e.g., trace heavy metals – so manage with care in liquid form). Once cured, the coating is inert and safe.

(All performance values above are based on panels coated to spec and cured properly. Real-

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world results assume correct application.)

Recommended Applications and Target Industries

Blackstone TC's unique blend of heat resistance, durability, and protective qualities makes it suitable for a wide range of applications across industries. Here are some of the key industries and components that benefit from Blackstone TC:

- Firearms & Defense: Ideal for weapon components that see high heat and friction. For example, machine gun barrels, suppressors, and muzzle devices can become extremely hot during sustained fire – Blackstone TC withstands these temperatures and preserves the metal. It also serves as a dry lubricant on bolts, slides, and internal parts, ensuring reliable cycling and reduced wear. Its corrosion resistance helps firearms resist sweat and harsh environments. Because it meets military dry film lube specs, it is great for armament applications that require both heat tolerance and lubrication (e.g., minigun bearings or artillery shell ejectors). Additionally, the semi-gloss black finish provides a non-reflective, tactical look on firearms.
- Automotive & Motorsports: Automotive applications are a prime area for Blackstone TC. Its heat-dissipating nature is used on radiators, intercoolers, and oil coolers to improve thermal efficiency. Coating a radiator in Blackstone TC, for instance, can help it radiate heat more effectively (black surfaces emit heat better) and protect the fins from corrosion (e.g., road salt). Similarly, engine blocks, cylinder heads, and intake manifolds benefit – Blackstone TC helps pull heat out of the metal, contributing to cooler operation, and shields against coolant and oil chemicals. High-performance and racing engines can run more reliably with critical parts coated to shed heat. The coating's thinness is a bonus for pistons or engine internals that require tight clearances (some builders use it on piston skirts or inside engine bays for thermal control). Even brake components (calipers, drums) can use Blackstone TC to help dissipate heat and resist brake fluid or debris exposure.

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Overall, whether it is a race car, off-road vehicle, or daily driver, Blackstone TC provides thermal management, longevity, and a custom look for automotive parts.

- Aerospace & Aviation: In aerospace, materials face extreme thermal stress and weight is critical. Blackstone TC is valuable for aerospace components such as turbine casings, engine exhaust cones, heat shields, and aircraft engine parts. It protects alloys from high-temperature oxidation and corrosion (for instance, on jet engine parts or rocket engine components) while adding no weight. The coating's ability to endure rapid thermal cycling (heating up and cooling down repeatedly) without cracking is essential for aerospace use. Blackstone TC's high-temp stability and strong adhesion mean it stays on even when parts expand or vibrate under jet engine operation. Additionally, its electrically conductive nature can be useful in spacecraft or satellite parts where static buildup must be avoided. In aviation piston engines, coating oil coolers or cylinder heads with Blackstone TC can aid cooling. Aerospace engineers choose Blackstone TC when they need a proven, mil-spec "thermal armor" for parts that see both intense heat and the need for reliability.
- Industrial & Manufacturing: Industrial machinery and equipment that operate at elevated temperatures or in corrosive conditions benefit from Blackstone TC's protective qualities. Examples include power generation equipment (turbine blades, boiler components), chemical processing plants (heat exchangers, reactor vessels), and metalworking tools (foundry molds, kilns). Blackstone TC's ceramic layer shields metal surfaces from oxidation at high heat and from chemical attack by caustic substances. Its durability and hardness guard against wear in high-friction areas (like sliding machine parts or valves). In oil and gas industries, it can coat engine parts or exhaust systems of generators and compressors to ensure they run cooler and last longer. The coating's thin profile is advantageous for industrial parts with tight tolerances (pumps, valves). Additionally, electronics & lighting industries use Blackstone TC for things like large heat sinks, LED lighting housings, and elec-

trical enclosures – anywhere heat needs to be drawn away to improve performance. The electronics sector appreciates that Blackstone TC can cool components (like audio amplifiers or computer heat sinks) while not insulating them electrically. Overall, in any industrial scenario requiring a combination of heat resistance, corrosion protection, and endurance, Blackstone TC is a go-to solution.

(In summary, Blackstone TC is versatile across industries: from guns to cars to jet engines. It is particularly suited to high-temp, high-stress environments where traditional coatings fail. Whether you are an automotive engine builder, a firearms manufacturer, or an industrial equipment engineer, Blackstone TC provides a reliable protective clear ceramic solution – in a sleek black color – to extend the life and performance of your components.)

Environmental and Safety Considerations

Using Blackstone TC comes with environmental and safety benefits, as well as responsibilities. Here are the key considerations regarding VOCs, handling, and disposal:

- VOC Compliance: Blackstone TC is formulated to be low in volatile organic compounds, meeting strict EPA regulations in all 50 states. This means it has minimal solvent emissions compared to many traditional coatings. For the end user, low VOC translates to reduced hazardous fumes during application – better for the environment and the operator. In fact, all Blackstone coatings are designed to be VOC-compliant and eco-friendlier than older high-solvent paints. (Blackstone TC uses solvents, but in a controlled, minimal way – always use in a well-ventilated area.) Additionally, the cured coating is inert and non-toxic, so coated parts do not emit any harmful substances in service.

Blackstone TC is designed with compliance in mind – it is a modern coating that avoids the nasty chemicals of the past. If you manage the application with standard care (PPE, ventila-

tion, proper waste disposal), it presents no undue hazards and is friendly to use in a professional or small shop setting.

Comparison to Similar High-Temp Coatings

How does Blackstone TC (Blackstone TC) stack up against other high-temperature clear/ceramic coatings? Below we compare key factors – gloss, color retention, and max temperature – as well as other features with both Blackstone's own alternatives and competitor products:

- Versus Competitor High-Temp Coating: When comparing Blackstone TC to other brands' high-temperature coatings (such as silicone-based header paints, engine enamels, or high-temp powder coats), several advantages emerge:
    - Temperature Rating: Many high-temp spray paints (e.g., auto parts store exhaust paints) are rated for around 1200°F continuous, 1500°F peak. Some specialized clear coats may only handle ~600°F before yellowing. Blackstone TC's 1800°F stability clearly surpasses these, offering a larger safety margin for extreme use. It means Blackstone TC can be used on parts (like firearms suppressors or industrial burners) where competitor coatings would fail or burn off.
    - Durability: Blackstone coatings are known for their physical toughness. Blackstone TC's 7H hardness and impact resistance mean it will not chip or scratch easily, whereas many competitors high-temp paints are quite soft (they often scratch off with a fingernail) or become brittle after heat cycling. High-temp powder coatings exist, but they typically cure at extremely elevated temperatures and tend to be thicker and prone to cracking under rapid temperature changes. In fact, Blackstone's own testing shows its high-temp ceramics have better thermal shock resistance than

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high-temp powder coatings– powders can crack or discolor when subjected to the same torture tests.

- Appearance (Gloss Level): Blackstone TC offers a semi-gloss, smooth finish, which is unique. Many competitors' high-temp coatings dry to a matte or chalky finish (for example, some stove paints or header paints are flat gray or flat black and can chalk at max temperature). And high-temp clears often yield a flat, milky look when over-heated. Blackstone TC, by contrast, retains a nice satin black look without turning white or ashy up to its limits. If one desires a bit of sheen on their engine or exhaust parts along with performance, Blackstone TC provides that aesthetic edge.
- Color Retention: Even among high-temp coatings, color stability is a challenge – some black paints turn grey with heat, and clears can yellow. Blackstone TC was evaluated for minimal ΔE color change (where $\Delta E<2.5$ is excellent) under harsh conditions. It keeps its color far better than most competitor coatings at elevated temperatures. For instance, a clear silicone-based coat on polished metal might start yellowing at a few hundred degrees, whereas Blackstone TC (though black in color) will not fade or change until extremely elevated temperatures, and even then, it just loses a bit of gloss rather than flaking.
- Thickness & Weight: Compared to powder coating or ceramic paint wraps, Blackstone TC's ultra-thin application is a plus. It does not noticeably alter part dimensions or add weight – important in racing and aerospace. Some competitors like plasma-sprayed ceramic coatings (e.g., those thick white thermal barrier coatings on exhausts) are heavy and thick, which can be a drawback if weight is a concern. Blackstone TC gives a micron-level thin solution, like a second skin on the part.
- Additional Functional Benefits: Blackstone TC's lubricating property is a distinctive advantage for moving parts (competitors do not offer that in a high-temp coating).

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Also, being electrically conductivemeans it will not interfere with grounding or electromagnetic considerations – whereas a competitor ceramic might insulate and require masking of grounding points.

- Cure Method: Many high-temp paints require the part to be heated gradually as part of the curing (for example, some header paints cure when you run the engine, or require an intricate bake at increasing temperatures). This can be inconvenient and result in incomplete cures if not done exactly. Blackstone TC, however, is fully cured in a controlled oven environment before the part is ever used, ensuring maximum performance from the outset. High-temp powder coats need an extremely high bake temperature (often 400°F+), which can be too high for some assemblies or cause warping; Blackstone TC's 300°F cure is gentle.

In summary, Blackstone TC outperforms typical high-temp clear or ceramic coatings in critical areas: it holds gloss and color better at high heat, withstands higher peak temperatures, and offers a tougher, thinner protective layer. Competitor products might be cheaper or come in a spray can, but they usually sacrifice longevity and performance – chalking, peeling, or rusting through after limited exposure. Blackstone TC is a professional-grade solution, often chosen when failure is not an option, and one wants the best balance of heat resistance, protection, and appearance. Whether compared to a high-temp clear powder coat or a silicone exhaust paint, Blackstone TC's industry-leading heat resistance and proven Blackstone durability make it a top choice for anyone seeking high-temperature protection with a premium finish.

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Typical Test Data Prior to Graphene Fortification

Test	Method	Value Blackstone DFL	Value Blackstone Plus
Dry Film Thickness (DFT)	Electromagnetic method ASTM D1400-87	25 µm (1 mil)	25 µm (1 mil)
Film Appearance	Eye and power magnification microscope	OK	OK
Adhesion			
Post Water Cross Hatch Adhesion	Adhesive tape after boiling ASTM D3359	OK(A)	OK(A)
Impact	D4145	OK(A)	OK(A)
Abrasion			
Taber Abrasion	Weight loss after wear of two abrasive wheels DFT loss ASTM D4060-95 Load: 1,000 g Number of cycles: 1,000 Set of abrasive wheels: CS17	80 mg 19 µm (0.8 mil)	24 mg 9 µm (0.1 mil)
Pencil Hardness	ASTM D3363	2B	
Corrosion			
Atlas Cell (hours)	Chemical resistance of coating ASTM B117-73 Temperature: 98°C (208°F) Test solution: 0.05 N HCl	<168 hr	<168 hr
Salt Spray	ASTM B117-73 Test solution: 5% salt in water Temperature: 35°C (95°F)	168 hr<x <336 hr	168 hr<x <336 hr
Gloss	ASTM 523		
	20°	0.2	0
	60°	4.5	3.0
	85°	18.4	13.0

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Typical Test Data Prior to Graphene Fortification

Test	Method	Value Blackstone HD	Value Blackstone TC
Dry Film Thickness (DFT)	Electromagnetic method ASTM D1400-87	1.6—4.0 mil	.25—.5 mil
Film Appearance	Eye and power magnification microscope		
Adhesion			
Post Water Cross Hatch Adhesion	Adhesive tape after boiling ASTM D3359		5B
Impact	D4145 / D2794		160 inch-lbs
Abrasion			
Taber Abrasion	Weight loss after wear of two abrasive wheels DFT loss ASTM D4060-95 Load: 1,000 g Number of cycles: 1,000 Set of abrasive wheels: CS17		
Pencil Hardness	ASTM D3363	2B	7H
Corrosion			
Atlas Cell (hours)	Chemical resistance of coating ASTM B117-73 Temperature: 98°C (208°F) Test solution: 0.05 N HCl		
Salt Spray	ASTM B117-73 Test solution: 5% salt in water Temperature: 35°C (95°F)		
Gloss	ASTM 523 20° 60° 85°		

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Technical Data Sheet Prior to Graphene Fortification

Properties	Blackstone DFL	Blackstone Plus
Color	Black, Grey	Black, Grey
Coverage, m2 /kg (ft2 /gal)	6.75 (277)	6.78 (280)
Weight Solids, %	23.0 – 26.0	23.5 – 26.5
Volume Solids, %	15.5 – 17.5	15.8 – 17.8
Density, kg/L (lb/gal)	1.06 (8.8)	1.07 (8.9)
Viscosity, cP	200 – 870	200 – 870
Maximum In-Use Temperature, °C (°F)	260 (500)	260 (500)
VOC content, US lbs/gal	6.48	6.25
Flash Point, SETA closed cup, °C (°F)	34.4 (93.9)	30 (86)
Food Contact	NO	NO

Blackstone DFL and Plus are one coat, solvent-based coatings specially formulated to provide a tough, durable film for dry lubrication, with excellent salt spray resistance. In addition, Blackstone Plus has exceptionally good abrasion resistance.

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Technical Data Sheet Prior to Graphene Fortification

Properties	Blackstone HD	Blackstone TC
Color	Black, OD, (FDE & Grey avail.)	Black
Coverage, m2 /kg (ft2 /gal)	6.42 (282) / 7.82 (347)	
Weight Solids, %	22.1—25.1 / 24.9—27.9	
Volume Solids, %	16.8—17.8 / 20.8—21.8	
Density, kg/L (lb/gal) / (g/mL)	1.077 (8.99) / 1.082 (9.03)	.83
Viscosity, cP	1400 – 2300 / 2000—3500	10
Maximum In-Use Temperature, °C (°F)	200 (392)	982 (1800)
VOC content, US lbs/gal	768.6 / 737.0	
Flash Point, SETA closed cup, °C (°F)	46 (115) / 40 (104)	
Food Contact	NO	NO

Blackstone DFL and Plus are one coat, solvent-based coatings specially formulated to provide a tough, durable film for dry lubrication, with excellent salt spray resistance. In addition, Blackstone Plus has exceptionally good abrasion resistance.

Exhibit A

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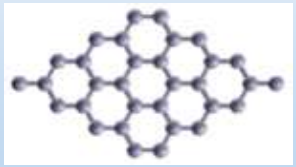
GRAPHENE

"The Wonder Material"

Single layer of carbon atoms with each atom bound to three neighbors in a honeycomb structure.

[ISO/TS 80004-13:2017: 3.1.2.1]



Graphene Oxide (GO)

Chemically modified graphene prepared by oxidation and exfoliation of graphite.

ISO 3.1.2.13

Graphene Oxide Dispersion

Liquid phase graphene processing for increased application use.

Functionalized Graphene Oxide

Animated graphene oxide to increase dispersibility in different matrices.

Reduced Graphene Oxide

Reduced oxygen content form of graphene oxide.

ISO 3.1.2.14

GRAPHENE BY IA COATINGS

WWW.IACOATINGS.COM

Exhibit B

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eurofins | MET Labs

IA COATINGS
BLACKSTONE (Blackstone DFL (Gr), Blackstone Plus (Gr), and Blackstone HD (Gr))
Test Data

2.0 MIL-STD-810G, Method 509.5, Salt Fog, RETEST Test Data

Test Engineer: Ulugbek Nadjimov

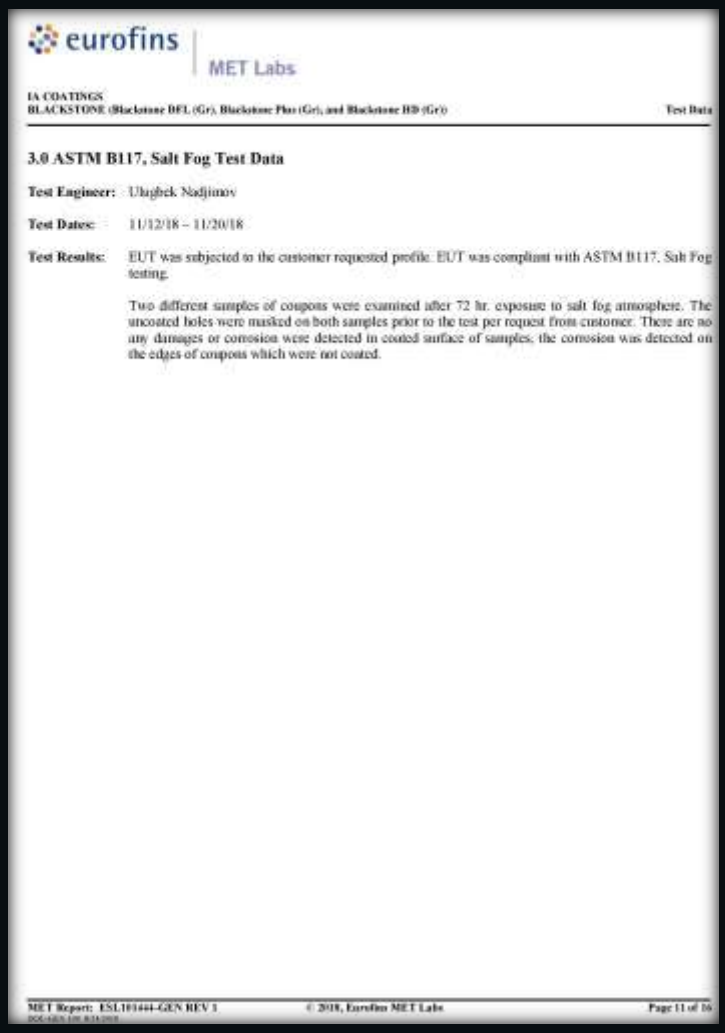
Test Dates: 11/14/18 – 11/20/18

Test Results: EUT was subjected to the customer requested profile. EUT was compliant with MIL-STD-810G, Method 509.5, Salt Fog testing.

Two different samples of coupons were examined after 72 hr. exposure to salt fog atmosphere. The uncoated holes were masked on both samples prior to the test per request from customer. There are no any damages or corrosion were detected in coated surface of samples, the corrosion was detected on the edges of coupons which were not coated.

Photograph 3, MIL-STD-810G, Method 509.5, Salt Fog, Retest, Pretest

MET Report: ESL181444-GEN REV 1 © 2018, Eurofins MET Labs Page 4 of 16



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IA COATINGS
BLACKSTONE (Blackstone DFL (Gr), Blackstone Plus (Gr), and Blackstone HD (Gr))
Test Data

3.0 ASTM B117, Salt Fog Test Data

Test Engineer: Ulugbek Nadjimov

Test Dates: 11/12/18 – 11/20/18

Test Results: EUT was subjected to the customer requested profile. EUT was compliant with ASTM B117, Salt Fog testing.

Two different samples of coupons were examined after 72 hr. exposure to salt fog atmosphere. The uncoated holes were masked on both samples prior to the test per request from customer. There are no any damages or corrosion were detected in coated surface of samples, the corrosion was detected on the edges of coupons which were not coated.

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GRAPHENE BY IA COATINGS

WWW.IACOATINGS.COM

CERAKOTE® VS ANODIZING

COLOR & APPLICATION OPTIONS

Cerakote offers over 200 unique and popular colors, and can be applied to all ferrous and non-ferrous metals, plastics, composites and many other substrates.

Due to the chemicals used in the process, anodizing offers a very limited color selection and can only be used on aluminum and titanium.

CONSISTENCY

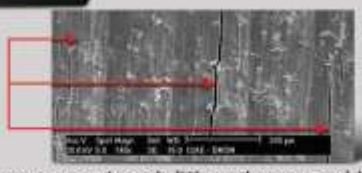
All **Cerakote** colors are held to a color consistency standard of a Delta E of 1 or less. Typically, the human eye can only see color differences greater than a Delta E of 2 or more.

Color consistency is known to vary widely from part to part and batch to batch due to chemical variations and subtle differences in the substrate that cannot be controlled.

IMPACT ON ALUMINUM ALLOYS

Cerakote does **NOT** detrimentally affect the fatigue properties of aluminum alloys.

Anodizing Stress & Fatigue



The anodizing process creates a brittle and porous oxide layer and tensile residual stress, which detrimentally affects the fatigue properties of aluminum alloys. This fatigue has been widely reported and documented.

https://www.finishing.com/153/15354ext.pdf
https://core.ac.uk/download/pdf/12042030.pdf

ENVIRONMENTAL IMPACT

Cerakote does not contain any heavy metals and is VOC exempt in all 50 states.

https://www.cerakote.com

The chromic acid anodizing process releases hexavalent chromium, a powerful carcinogen, into the environment. As a result, the use of hexavalent chromium is becoming increasingly restricted by regulations.

https://www.finishing.com/153/15354ext.pdf

Images above are for illustrative purposes only

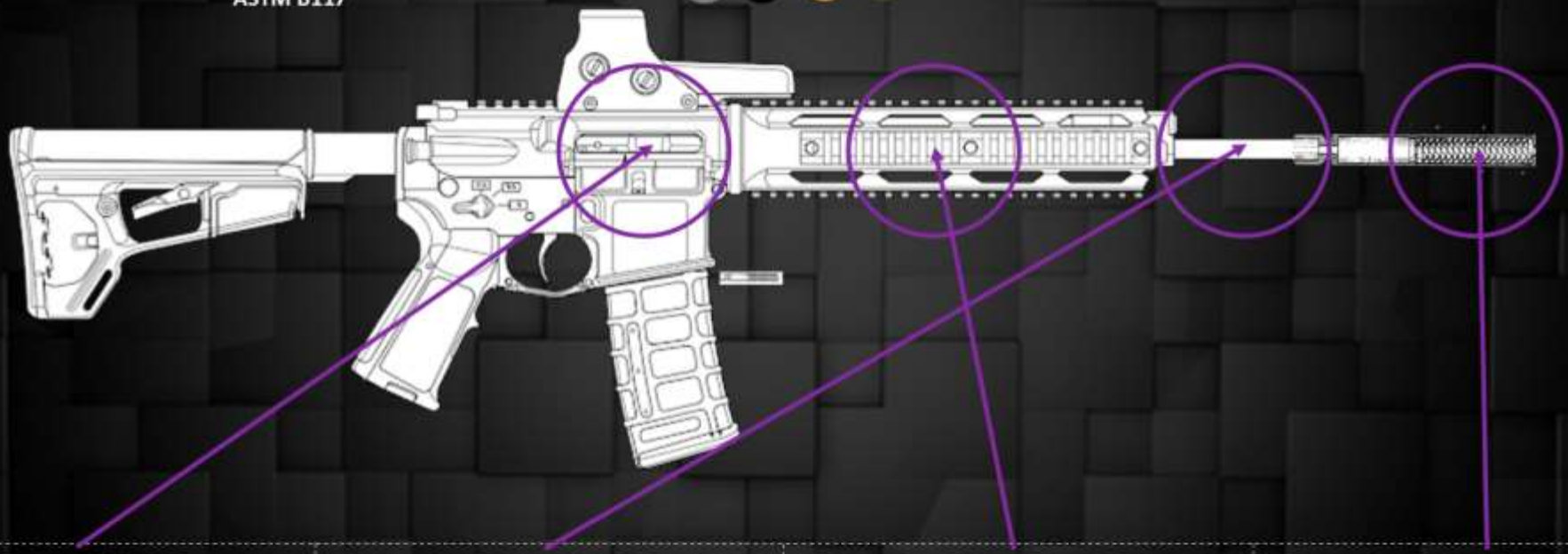
BLACKSTONE COATING

with Teflon® and Graphene by Innovative Aspects

Blackstone is a revolutionary coating featuring Teflon® and Graphene. Graphene is the single atomic layer of Graphite, adding extreme strength, heat reduction, and superlubricity to firearms. Blackstone is re-coatable, allowing all 4 variations to work together, for the best results.

Meets MIL-STD-810G Method 509.5
ASTM B117

Available in Greystone, Blackstone, Sandstone, and Olive Drab



BLACKSTONE DFL (303)

Modified for internal components; reduces friction and thus heat. Improving lubricity thru Graphene and Teflon® for a DFL effect. Great for bolt carrier groups and fire control systems.

BLACKSTONE Plus (313)

Strong, durable, & great at heat management. 313 improves the thermal barrier for muzzle brakes, barrels, gas blocks, and the OD of silencers, and chassis systems.

BLACKSTONE HD (406)

Engineered & specifically designed for external components for ultimate scratch, wear, chemical, and environmental resistance. Perfect for upper and lower receivers, and handguards.

BLACKSTONE TC (202)

Extreme heat mitigation thru thermally conductive control. Blackstone on the interior of handguards, silencers, baffles, and heat shields transfers heat away from the energy source.

More Lubricity | Balanced | More Durability | Extreme Temp

GRAPHENE

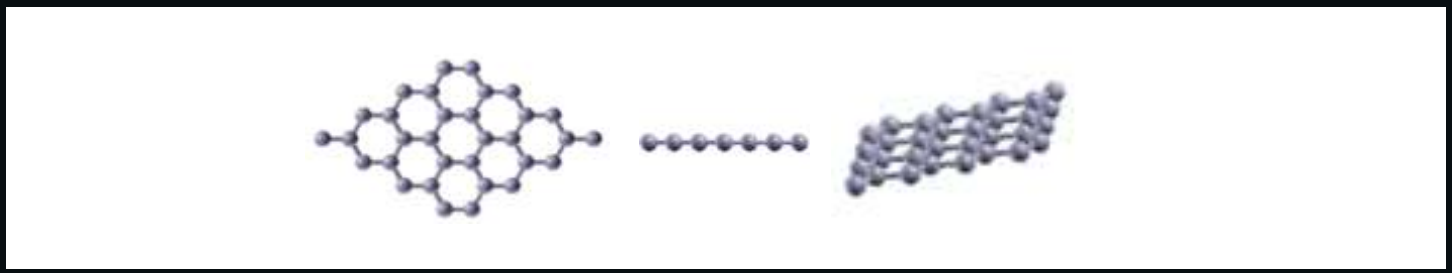
Graphene, Graphite, and Diamond:
A Comparative Analysis of Carbon Allotropes

Introduction

Carbon, a versatile element, exhibits remarkable diversity in its allotropic forms, including Graphene, graphite, and diamond. These materials, despite being composed solely of carbon atoms, display distinct physical and chemical properties due to variations in their atomic arrangements. This document examines the structural characteristics of Graphene, graphite, and diamond, as defined by the International Standards Organization (ISO), and explores their interrelationships and unique attributes.

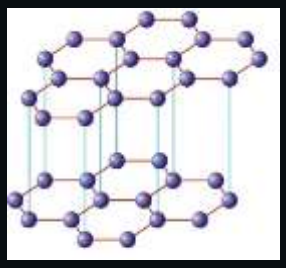
Graphene: Structural Definition

Graphene is defined by the ISO as a "single layer of carbon atoms with each atom bound to three neighbors in a honeycomb structure" (ISO/TS 80004-13:2017). This two-dimensional (2D) material consists of carbon atoms arranged in a hexagonal lattice, where each atom forms covalent bonds with three adjacent carbon atoms in a planar configuration. Graphene serves as a fundamental structural unit for many carbon-based nanomaterials, owing to its exceptional strength, conductivity, and flexibility.

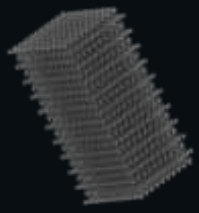


GRAPHENE

Graphite: A Layered Allotrope

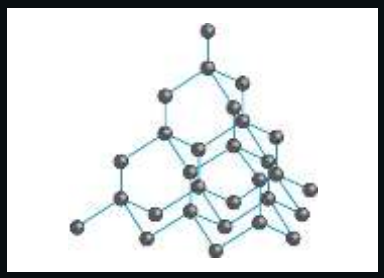


Graphite is characterized by the ISO as an "allotrope of the element carbon, consisting of Graphene layers stacked parallel to each other in a three-dimensional, crystalline, long-range order" (ISO/TS 80004-13:2017). In graphite, individual Graphene sheets are weakly bonded by van der Waals forces, resulting in a layered structure. Each carbon atom within a layer is covalently bonded to three others in a planar arrangement, while interlayer interactions involve weaker vertical connections between one or two additional carbon atoms. This structure imparts graphite with properties such as lubricity and a relatively low hardness (1–2 on the Mohs scale).



Diamond: A Cubic Configuration

In contrast, **Diamond** is defined as "a mineral consisting essentially of carbon crystallized in the isometric (cubic) crystal system" (ISO 18323:2015). Its three-dimensional structure features carbon atoms arranged in a tetrahedral lattice, with each atom covalently bonded to four neighbors. This highly symmetrical, interlocking arrangement results in diamond's exceptional hardness (10 on the Mohs scale), high refractive index, and impermeability, distinguishing it significantly from both Graphene and graphite.



GRAPHENE

Comparative Analysis

Graphene, graphite, and diamond exemplify how atomic arrangement dictates material properties. Graphene, as a single-layer allotrope, serves as the foundational building block for graphite, where multiple Graphene layers are stacked. However, diamond's cubic structure does not incorporate Graphene or graphite directly; instead, it represents a distinct reconfiguration of carbon atoms. Conversely, neither graphite nor diamond contains the other, though both graphite and diamond are ultimately derived from carbon's bonding versatility.

The distinct properties of these allotropes—such as hardness, specific gravity, lubricity, and chemical reactivity—arise from their structural differences. For instance, graphite's softness and lubricity contrast sharply with diamond's extreme durability, while Graphene's 2D nature enables unique applications in nanotechnology. These variations underscore the importance of studying each allotrope independently to understand their behavior and potential interactions with other substances.

Conclusion

The allotropes of carbon—Graphene, graphite, and diamond—demonstrate the profound impact of molecular structure on material properties. By manipulating the arrangement of carbon atoms, it is possible to tailor these materials for specific applications, from lubricants and conductors to cutting tools and nanomaterials. Graphene's role as a constituent of graphite highlights its significance, yet the absence of direct structural overlap between graphite and diamond emphasizes the diversity within carbon-based materials. Continued research into these allotropes is essential for advancing material science and engineering.

References

International Standards Organization. (2017). *ISO/TS 80004-13:2017, Nanotechnologies—Vocabulary—Part 13: Graphene and related two-dimensional (2D) materials*. Retrieved from https://www.iso.org/obp/ui/#iso:std:iso:ts:80004:-13:ed-1:v1:en

International Standards Organization. (2015). *ISO 18323:2015, Jewelry—Consumer confidence in the diamond industry*. Retrieved from https://www.iso.org/obp/ui/#iso:std:iso:18323:ed-1:v1:en:term:2.4

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