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Cerakote™
FIREARM COATINGS
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H-Series CERAKOTE™ Firearm Coatings

The unique formulation used for Cerakote™ firearm coatings enhances a number of physical performance properties including: abrasion/wear resistance, corrosion resistance, chemical resistance, impact strength, and hardness. Each of these properties is rigorously tested to guarantee that Cerakote™ products remain at the forefront of the firearm coatings market. For this study, the performance properties of Cerakote™ H-146 Graphite Black were compared to the products of two firearm coatings competitors, denoted as C1 and C2. Each coating was evaluated on nine important aspects including performance and cost. These results are summarized in table 1, shown below, and a more extensive description of the results and procedures is given in the following paragraphs.

Table 1. Performance comparison of Cerakote™ H-146 to competitor firearm coatings, C1 and C2.

Specification	Cerakote™	C1	C2
Taber Abrasion Testing (ASTM D4060)	Wear cycles per mil: 5212	Wear cycles per mil: 597	Wear cycles per mil: 418
Corrosion Testing (ASTM B117)	Corrosion-free at: 1000 hrs	Onset of Corrosion: 100 hrs	Onset of Corrosion: 45 hrs
Pencil Hardness (ASTM D3363)	9h	9h	7h
Adhesion Cross-Cut Tape (ASTM D3359)	5b	5b	5b
Mandrel Bend (ASTM D522)	32%	32%	32%
Impact (ASTM D2794)	160 inch-lbs	160 inch-lbs	140 inch-lbs
Chemical Resistance	Excellent	Excellent	Good
Theoretical Coverage (ft ² /gal at 1 mil thickness)	513	250*	321
Cost (\$/ft ²)	\$0.58/ft²	\$0.65/ft ²	\$0.99/ft ²
VOC Compliance	VOC compliant in all 50 states	Non compliant	Non compliant

* Theoretical coverage if applied according to manufacturers' specifications of 0.5 mil.

Taber Abrasion Testing¹

¹ Taber abrasion testing performed by Anachem Laboratories, Inc., El Segundo, CA.

Taber abrasion testing was performed to compare the wear resistance of Cerakote™ H-146 Graphite Black to products C1 and C2. This testing was performed in accordance with ASTM Standard D4060 by an independent testing facility.

Each coating was applied to a set of steel panels according to the manufacturers' instructions. A CS-17 taber abrasion wheel with a 1000 g weight was used for the abrasion testing. The abrasion wheel was rotated at a constant speed and the coating loss for each product was calculated. These results were used to determine the wear cycles per mil, which is an indicator of the rate of coating thickness loss. Cerakote™ H-146 required 5212 cycles to remove a mil of coating whereas the wear cycles per mil for C1 and C2 were 597 and 418, respectively. These results are illustrated in figure 1. This study shows that Cerakote™ is up to 12 times more wear resistant than competitive coatings.

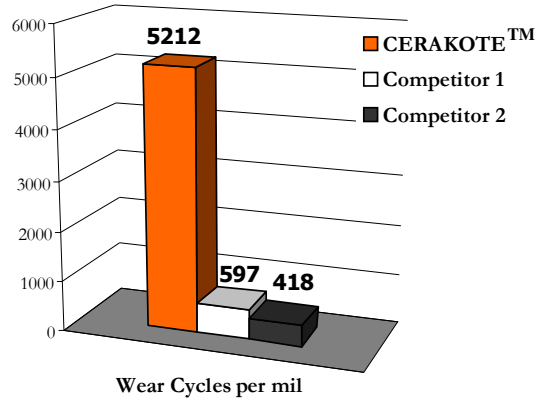


Figure 1. Wear cycles per mil for three coatings (Cerakote™ H-146, C1, and C2) tested using taber abrasion according to ASTM Standard D4060. All taber abrasion testing was performed by an independent testing facility.

Corrosion Testing

Testing was performed to compare the corrosion resistance of coatings C1, C2, and Cerakote™ H-146. The panels were tested under a corrosive environment according to ASTM Standard B117.

Each coating was applied to a set of steel panels and in accordance with the manufacturers' directions. Next, the panels were placed in a chamber and continuously exposed to a 5% salt water solution. The panels were checked for corrosion at specific intervals of 45, 160, 255, 385, 675, 850, and 1000 hours. A photo of the panels tested in the salt spray is shown in figure 2. The panels shown in figure 2 were removed from the salt spray at 385 hours in order to depict the variation of corrosion protection provided by each product. At 1000 hours Cerakote™ H-146 was not corroded; however, C1 and C2 completely failed. C1 and C2 experienced corrosion onset at 100 hours and 45 hours, respectively. This study shows that Cerakote™ preserves the life of a firearm 10 to 25 times longer than competitive coatings.



Figure 2. From left to right: C1, Cerakote™ and C2 coated panels following a 385 hour cycle in a 5% salt spray to test for corrosion protection capability. Cerakote™ provides 10 to 25 times more corrosion protection than competitive products.

Chemical Resistance

The ability of Cerakote™ H-146 to resist chemical attack was tested by dipping coated panels into a series of solvents to which the coating may be exposed during regular use or extreme conditions. The panels were placed in the solution and allowed to sit for 24 hours. Afterward, the samples were removed, analyzed and assigned a rank depending on the resistance to each specific chemical. The results of this test are shown in table 2. The performance of Cerakote™ H-146 was classified as excellent for 14 of the solvent tests. This indicates that the coating was not affected following a 24-hour immersion in the solvents. The coating also showed good resistance to HCl and experienced only a slight change in texture after a 24-hour immersion.

Table 2. Chemical resistance of Cerakote™ H-146 to 15 different solvents.

Solvent	Cerakote™ H-146
WD-40	★★★★
Motor Oil	★★★★
Gun Cleaner	★★★★
Lacquer Thinner	★★★★
Mineral Spirits	★★★★
Methyl Ethyl Ketone	★★★★
Gasoline	★★★★
Diesel	★★★★
Graffiti Remover	★★★★
Brake Cleaner	★★★★
Denatured Alcohol	★★★★
Paint Stripper	★★★★
5% HCl Solution	★★★
Acetone	★★★★
Ammonia	★★★★

★★★★ = excellent chemical resistance ★★★ = good chemical resistance
 ★★★ = fair chemical resistance ★ = poor chemical resistance

Determination of Physical Properties

Additional analyses were performed to compare the physical properties of each coating. These tests were used to determine the hardness, adhesion, and impact strength. Mandrel bend testing was also performed to analyze the flexibility of each coating. These results are displayed in table 3. Coating C2 is the weakest coating, with low hardness, low impact strength and a higher susceptibility to scratching. Coatings C1 and Cerakote™ H-146 have comparable hardness and impact strength. Cerakote™ H-146 has the maximum attainable hardness, adhesion, and flexibility for each test.

Table 3. Comparison of the physical properties of three coatings (Cerakote™ H-146, C1, C2).

Specification	Cerakote™ H-146	C1	C2
Pencil Hardness (ASTM D3363) Maximum: 9h	9h	9h	7h
Adhesion Cross-Cut Tape (ASTM D3359) Maximum: 5b	5b	5b	5b
Mandrel Bend (ASTM D522) % elongation capable without coating failure*	32%	32%	32%
Impact (ASTM D2794) (inch-lbs)	160	160	140

* 32% elongation corresponds to a 180° bend over a 1/8 inch mandrel without coating failure

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