RICHTER PRECISION INC.

Armor Guard and S-Line

PVD, CVD & DCD COATING TECHNOLOGY

Advanced Coating Technology for the
Shooting and Sporting Industries

VETERAN OWNED

RICHTER PRECISION INC. ● ● ●

Richter Precision Inc. is North America's preeminent PVD, CVD and DCD coating company. Since 1978, our focus has been on helping customers improve the efficiency and profitability of their tools and products through the deposition of advanced thin-film coatings. Our team is bringing this same philosophy to the firearms industry. We can help you to improve both the appearance and function of your firearm.

What Is Armor Guard and S-Line? ● ● ●

Armor Guard is a family of PVD and CVD coatings that have been engineered for use within the firearms industry. This range of processes and compositions allows us to match the best possible coating for each application, thereby ensuring the best performance based on the customer's needs.

S-Line utilizes DCD, a proprietary low temperature coating process, to synthesize Boron Nitride (BN). This film has an extremely high temperature resistance combined with high lubricity, making it a particularly good coating for internal firearm components.

Major Attributes and Benefits of our Armor Guard and S-Line Coatings

- DLC, Me-DLC, BN, TiN, AlTiN & more!
- High Hardness
- Low Friction
- Wide Spectrum of Colors Available
- Low Processing Temperatures
- High Temperature Resistance
- Reduced Carbon Fouling
- Erosion Protection
- Improved Corrosion Resistance

Introduction to Armor Guard and S-Line Deposition Technologies

Physical Vapor Deposition (PVD) is a term used to describe a family of vacuum coating processes. The most common of these PVD coating processes are evaporation (typically using cathodic arc or electron beam sources), and sputtering (using magnetic enhanced sources or "magnetrons", cylindrical or hollow cathode sources). All parts are processed in a vacuum chamber at working pressure (typically 10^{-2} to 10^{-4} mbar) and involve bombardment of the substrate to be coated with energetic positively charged ions during the coating process to promote high density. Additionally, reactive gases such as nitrogen, acetylene or oxygen may be introduced into the vacuum chamber during metal deposition to create various compound coating compositions. The result is a very strong bond between the coating and the substrate and tailored physical, structural and tribological properties of the film.

Chemical Vapor Deposition (CVD) is an atmosphere controlled process conducted at elevated temperatures (~1925° F) in a CVD reactor. During this process, thin-film coatings are formed as the result of reactions between various gaseous phases and the heated surface of substrates within the CVD reactor. As different gases are transported through the reactor, distinct coating layers are formed on the tooling substrate. For example, TiN is formed as a result of the following chemical reaction: $TiCl_4 + N_2 + H_2$ 1000° C $\rightarrow TiN + 4\ HCl + H_2$. Titanium carbide (TiC) is formed as the result of the following chemical reaction: $TiCl_4 + CH_4 + H_2$ 1030° C $\rightarrow TiC + 4\ HCl + H_2$. The final product of these reactions is a hard, wear-resistant coating that exhibits a chemical and metallurgical bond to the substrate. CVD coatings provide excellent resistance to the types of wear and galling typically seen during high load applications.

Dynamic Compound Deposition (DCD) is a proprietary low temperature coating process that synthesizes dry-film lubricants and wear resistant coating compositions. DCD is based on the principle of in situ mechanical activation and chemical transformation, and leads to considerably decreased friction coefficients and increased durability of the coating layers. Due to the specific conditions of synthesis, DCD coatings develop micro- and macro-structures that are well adapted for conditions of severe contact loading. For this reason, the DCD process is primarily suited to anti-friction, slide-wear, and high-load applications. While these coatings work well by themselves in tribological applications, we have also had very good success using DCD coatings in conjunction with various PVD, CVD and TD coating compositions. These combinations have been particularly effective in high wear applications.

General Comparison of Coating Process Characteristics

Process Characteristics	PVD Physical Vapor Deposition	CVD Chemical Vapor Deposition	DCD Dynamic Compound Deposition
Method	Processed in a vacuum chamber (10^{-2} to 10^{-4} Torr)	Processed in atmospheric or vacuum reactor	Processed in a proprietary vessel
Temperature	Low process temperature (320° to 800° F)	High standard process temperature (1925°F)	Low temperature process (100° F)
Deposition Limitations	Line of sight process	Coats wherever gases contact the tool surface	Coats wherever coating media contacts the surface
Bond Type	Physical	Chemical & metallurgical	Mechano-chemical
Average Thickness	1-5 µm, or .00004-.0002”	4-12 µm, or .00016-.00047”	0.5-2 µm, or .00002”-.00008”
Material Limitations	Suitable for a wide range of substrates	More limited range of substrates than for PVD	Suitable for a wide range of substrates
Tolerances	Ideal for closely toleranced components (+/-.0001)	Requires loose tolerances (ex.: +/-.0005 per 1.0” dia.)	Ideal for closely toleranced components (+/-.0001)
Post-Processing	No heat-treating required after coating	Heat-treating required on steel parts	No heat-treating required after coating
Edge Build-Up	No excessive coating build-up	Requires hone on edges due to thicker coating	No excessive coating build-up
Surface Finish	Coating generally replicates existing surface finish	Post-coating polish can achieve good finishes	Coating may have slight matte effect

Applications for the Firearms Industry

- ***Slides***
- ***Suppressors***
- ***Bolt Carriers/Carrier Groups***
- ***Muzzle Breaks***
- ***Frames***
- ***Internal Parts***
- ***Bolt Actions***
- ***Shotgun Receivers***
- ***Barrels***
- ***Upper/Lower Receivers***
- ***Choke Tubes***
- ***...and more!***

Proprietary Name	Type	Composition	Color	Thickness (microns)	Coefficient of Friction
Armor Guard C	PVD	TiN	Gold	1-5	0.35
Armor Guard C5	PVD	TiCN	Copper/Bronze	1-5	0.3
Armor Guard C6	PVD	AlTiN	Violet/Black	1-5	0.35
Armor Guard C12	PVD	Me-DLC	Black	1-5	0.1
Armor Guard C14	PVD	C-DLC	Black	1-5	0.1
Armor Guard ORB	PVD	Proprietary	Mocha	1-5	0.35
Armor Guard Coyote	PVD	Proprietary	Brown	1-5	0.35
Armor Guard Duplex Nickel	PVD	Proprietary	Nickel	1-5	0.35
Armor Guard Duplex SS	PVD	Proprietary	Stainless Steel	1-5	0.35
Armor Guard Flat Dark Earth	PVD	Proprietary	Earth	1-5	0.35
Armor Guard Graphite	PVD	Proprietary	Med. Gray	1-5	0.25
Armor Guard H	CVD	TiN/TiCN/TiC/TiN	Gold	6-9	0.35
Armor Guard H+	CVD	TiC	Gray	6-9	0.35
Armor Guard H+Sx	CVD	TiC+BN	Gray	6-9	0.15
S-Line Sx	DCD	BN	Gray/Black	0.5-1.0	0.1

Data has been generated from lab samples. Characteristics may vary depending on customer's material, surface condition and part geometry.

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