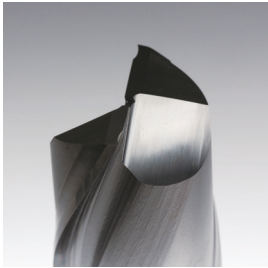




CARBOZEN™ COATING



DLC Coating for high hardness and low friction

Customized coating solution for durability improvement of various products



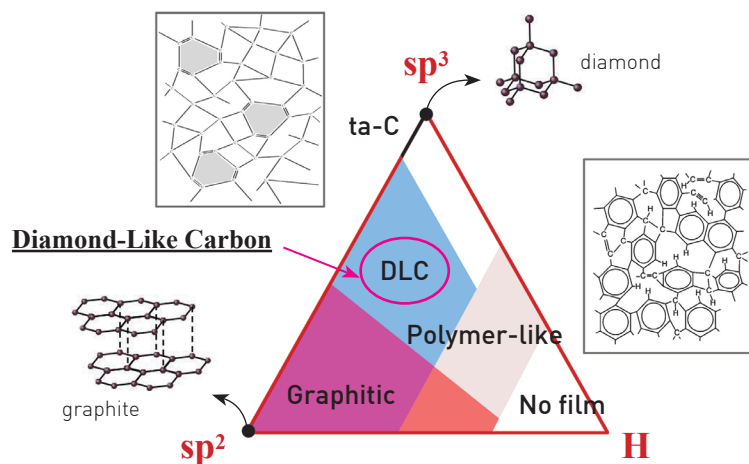
> CARBOZEN™ DLC(Diamond-Like Carbon) COATING

DLC means 'Diamond-Like-Carbon'. It is technology by which the carbon (the main component of diamond) is coated on substrate with plasma in a high vacuum. At this time, the coating layer appears as an amorphous structure and also has a high level of hardness, low friction, and wear-resistant properties. It is customized coating to improve the durability of products.



> Characteristics of CARBOZEN™ DLC

- High level of surface hardness: 1,500 ~ 6,000Hv → Improves the surface wear of products as a wear-resistant coating
- Low friction coefficient : 0.01 ~ 0.2 → Improves fusion problem on mold surface as a solid lubrication coating
- Chemical stability → Corrosion resistant and anti-sticky improving
- Carbon coating of amorphous : $R_a \sim 0.3 \text{ nm}$ → Superior surface roughness, possible to apply as mirror coating
- Low temperature coating : $< 70^\circ \text{C}$ → Non thermal deformation of substrate



CARBOZEN™-H COATING

> G-DLC

Coating solution of excellent durability with high hardness, low friction, and wear-resistant properties!

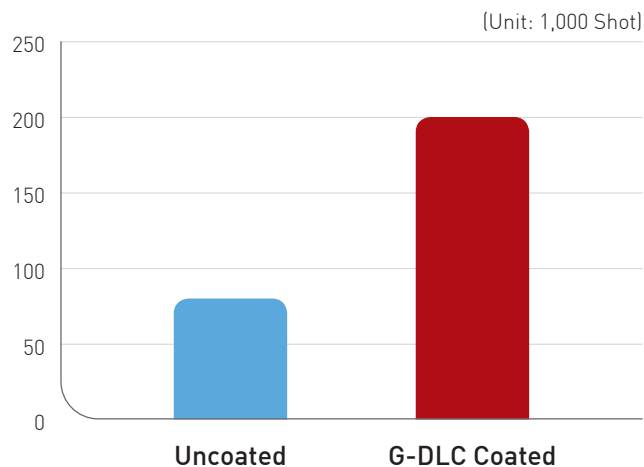
G-DLC coating technology can be applied in various fields such as molds, injection molds, cutting tools, electronics and auto parts. Therefore we will reduce customer's cost through improving productivity and quality by extending the lifespan of tools.



Characteristics of G-DLC

- Improved corrosion resistance ➡ 100% corrosion prevention after coating
- Elevation of productivity ➡ Saves maintenance and repair time after coating
- Quality improvement ➡ Eliminates defective elements by decreased use of mold release
- Lifespan extension ➡ Maximum of X2.5 lifespan extension than before coating

< Lifespan of injection mold >



❖ Uncoated lifespan : 80,000 shots
G-DLC lifespan : 200,000 Shots
(Increase productivity by a maximum of X2.5)

CARBOZEN™-H COATING

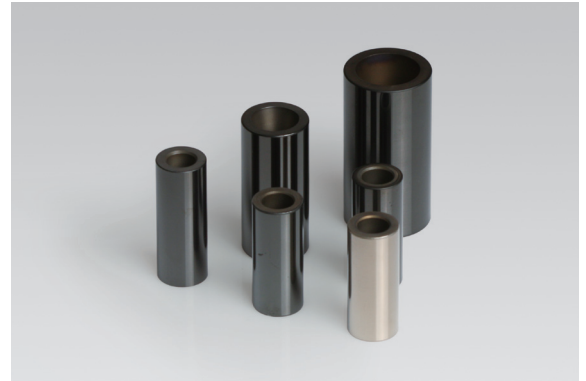
> S-DLC

Specialized super low friction coating solution!

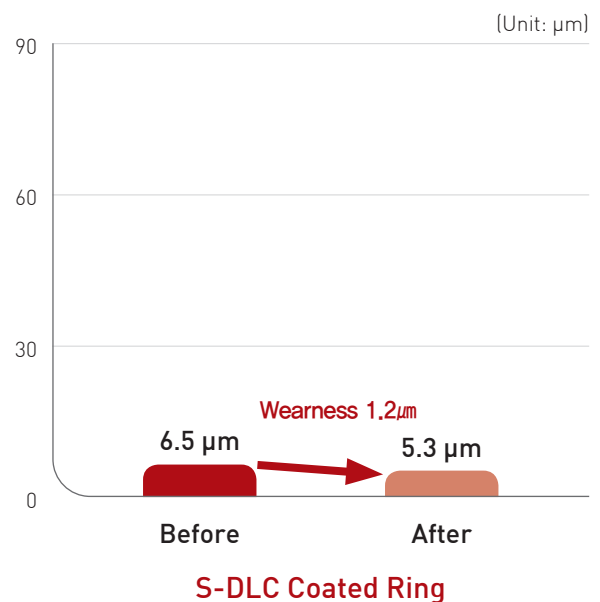
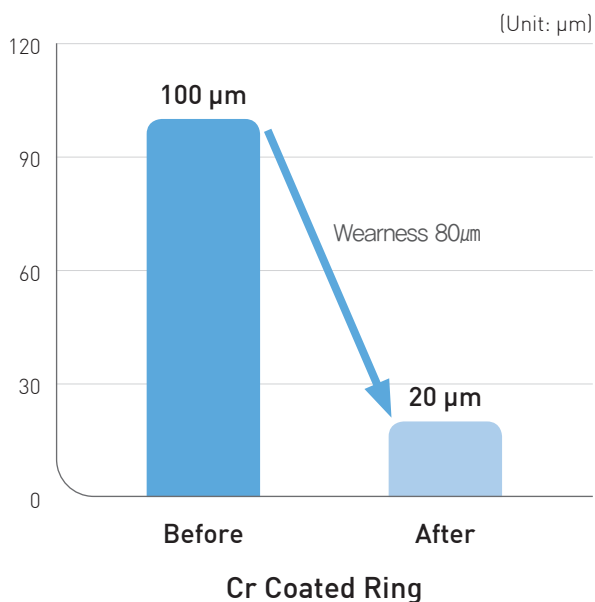
S-DLC is coating technology which maximizes the low-friction property of existing DLC.

It can lower friction coefficient to 0.05. If you apply auto parts, you can see an improvement effect of fuel efficiency more than 5%.

You can observe lifespan and quality improvement when applying to parts requiring friction improvement.



< Wear test vehicle's piston ring >
(900hr Wear test)

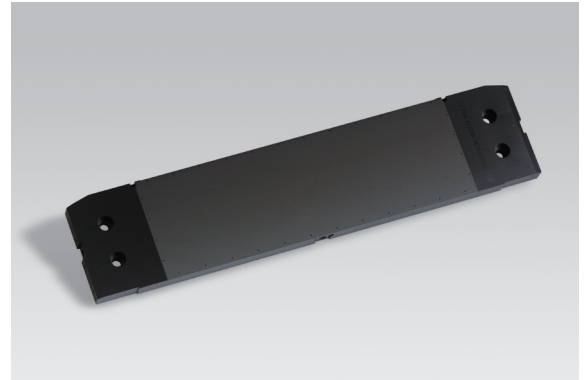


> σ -DLC™

As an electrical resistance-controllable carbon coating, this is a customized coating solution for conductivity and insulation!

Through control of electric resistance to $10^3 \sim 10^{10} \Omega/\text{cm}^2$, σ -DLC™ is a customized coating service for equipment requiring electrical resistance control, such as the semi-conductor inspection equipment – Probe, metallic bipolar plates for PEMFC, and bio sensors.

- Adaptable for mass production and realize economical efficiency : coating thickness < 100 nm
- Higher conductivity and corrosion resistance than rare metal



> N-DLC

Customized coating solution which's frictional force can be adjusted depending on purpose of use!

This is an innovative coating solution which's frictional force can be quantified depending on the environment and intended use in a friction coefficient range of between 0.2 and 0.5. It can be applied in special environments such as electrical control module parts or for increasing efficiency of vehicle window wipers, etc.



CARBOZEN™-C COATING

> Plane-DLC

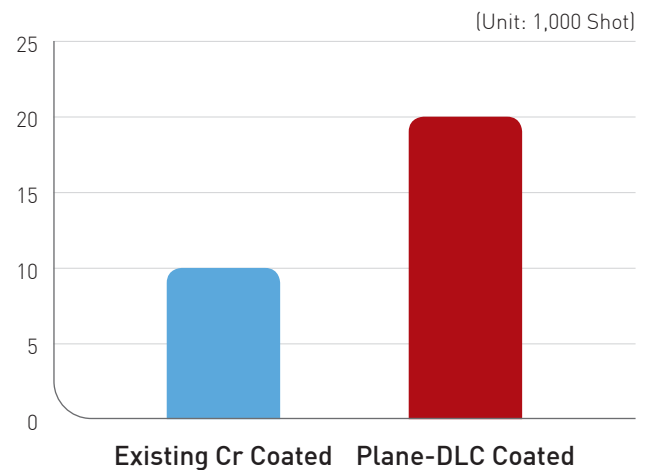
Non-defective, good roughness coating solution without drop-let or pin hole!

Since there is no pin hole nor drop-let on the product surface, it can prevent breakage of the mold through preventing the fusion of molded articles with the mold, thereby improving its releasing property.

Plane DLC can increase the life span of parts and substantially improve quality when applied to products such as specular component light guide plates, CD mold or Coin Head of the display industry.



< Lifespan of Coin Head >



❖ Up to two times longer life than conventional Hard Cr coating

> Inner-DLC

Effective solution for compressor parts to improve the corrosion-resistance and wear-resistance of pipe's inner side!

This is coating technology which uses HCD (Hollow Cathode Discharge) and is applied to the inner side of products which have been difficult to apply coating previously.

- Application of Inner-DLC ➡ Compressor of appliances: Improvement of more than 15% energy efficiency by improving durability
- ➡ Chemical plant pipe: Reduces the cost of maintenance by improving wear and corrosion resistance



CARBOZEN™-FA COATING

> ta-C

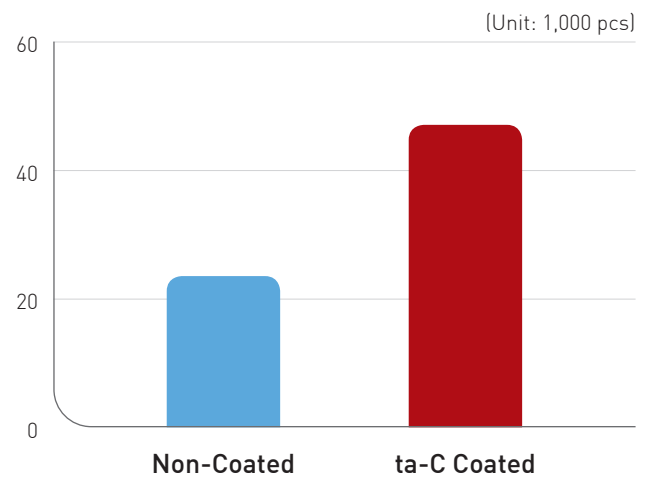
This is a 0% hydrogen DCL high hardness coating solution which consists of 99.9% pure carbon with completely controlled macro-particles!

High-hardness thin film of 3,000 ~ 6,000 Hv with perfectly controlled macro-particles is completed by J&L TECH's magnetic filter and arc discharge of the CARBOZEN FA SYSTEM.

- Possible to have an ultra-smooth surface through dual bent filtering
- High adhesion to substrate
- Easy maintenance and high reproducibility



< Lifespan of Tap >



- ❖ Tool : Oil hole M3 Tap / D6 x 50, HSS
- ❖ Workpiece : Al6061

Application of ta-C

- ➡ Micro drills, end mills, cutting tools and engine component parts
- ➡ Machining tools of nonferrous metals like Al, Cu, and the tools for implantation
- ➡ Improving the roughness of surfaces by preventing the fusion of tools and nonferrous metals
- ➡ Prevention of blade damage
- ➡ Heat suppression during process by reducing frictional heat
- ➡ Lifespan extension more than 5 times for tools
- ➡ Solid lubricating function when applied to engine component parts

> DLC Coating Properties

Coating Service	G-DLC	S-DLC	σ -DLC™	N-DLC	Plane-DLC	Inner-DLC	ta-C	MIRAGE™
Hardness (HV)	1,800~3,000	1,600~2,000	2,100	1,800	1,500~2,200	1,500~2,200	3,000~6,000	1,400
Friction coefficient (Dry type)	< 0.2	< 0.15	< 0.2	0.2~0.5	< 0.15	< 0.15	< 0.2	< 0.15
Coating thickness (μm)	Changeable depended on the application							
Processing temp. (°C)	< 200	< 200	< 450	< 200	< 200	< 200	< 200	< 100
Max temp. of application (°C)	250	250	250	250	250	250	400	250
Coating color	Black	Black	Black	Black	Black	Black	Black, Rainbow	Black, Rainbow
Major characteristics	Lubrication, Prevent sticking	Lubrication, Prevent sticking	Conductivity, Corrosion resistant	Special lubrication, Prevent sticking	Pinhole free coating, Prevent sticking	Corrosion resistant, Durability of abrasion	Lubrication, Prevent sticking	Polymer resins, Prevent sticking
Applications	Injection mold, Mechanical part, Sliding part, Vehicle part, Diesel injection, Pump part, Cutting tool (Non-ferrous metal)	Vehicle part, Printed electronics	Conductive required part, Semiconductor probe, PEMFC bipolar plate	Special friction required part	CD/LCD mold, UV mold	Chemical plant pipe, Compressor	Micro drill, Non-ferrous metals, Vehicle part	Printed electronics