



eternal carbon

eternal carbon
the advanced coating

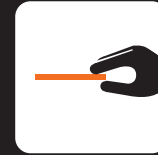
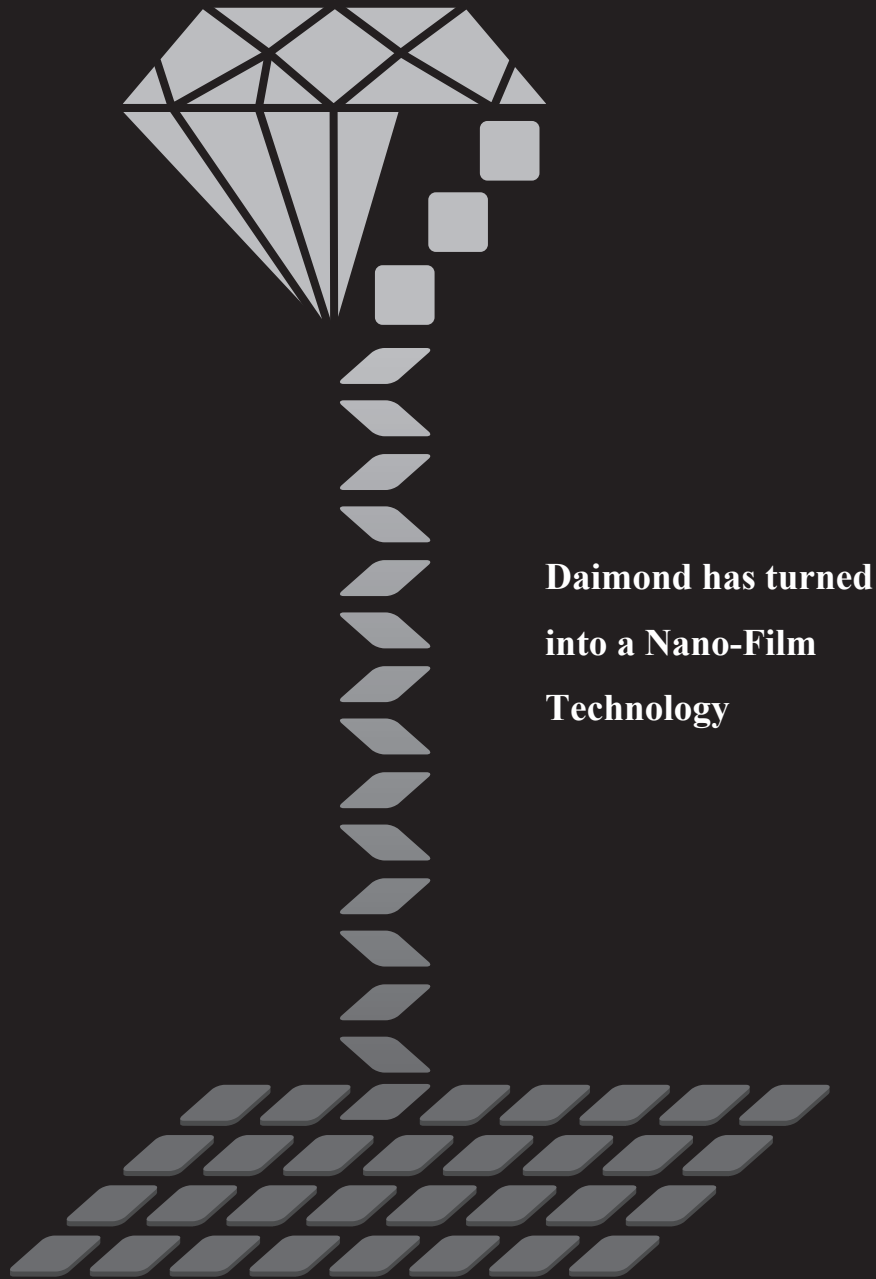
Contact us about S-DLC

iMott

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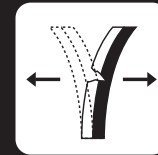
E-mail info@imott.co.jp

WEB <http://www.imott.co.jp>



Ultra-Thin

S-DLC (eternal carbon) Film is nano thin



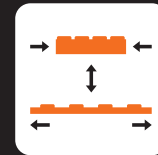
Durable

Gain Durability to Metal Fatigue & Abrasion



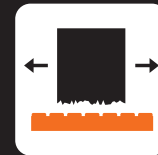
Flexible

Adhere to Felxible Material



Expandable

Adhere to Thermal Expansion



Anti-friction

Reduce Friction rate



Shock-resistant

Gain Surface Intensity of the Material

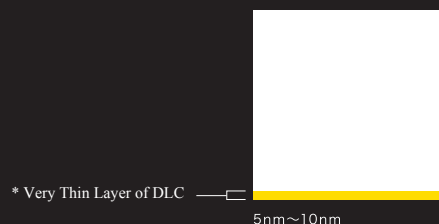
Problems of Pre-existing DLC

■ Incompatible to Flexible Materials

- * Exfoliation of the Film on Material Deformation
- * Create Micro-cracks on Material Movement

■ Incompatible to Insulating Materials

- * Occurrence of Static Electricity on the Surface of the Base Material (Cannot create thick layer of DLC)
- * Thermal Deformation of Base Material on Vacuum Deposition Process



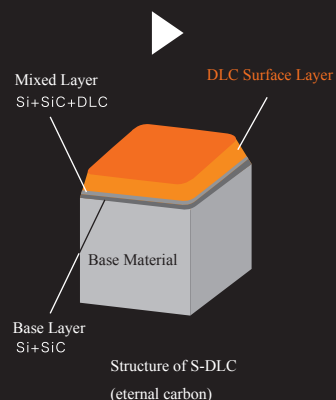
■ Incompatible to Thermal Expansion Materials

- * Exfoliation of the Film on Material Expansion (DLC=low expansion rate)
- * Create Micro-cracks on Base Material Expansion

素材別の線膨張係数の表

Stainless Steel	Steel (Fe)	Polycarbonate	PET	Rubber
17.3	11.7	70	100~180	77

Solution

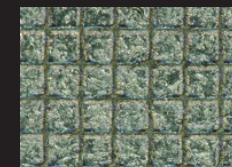


eternal carbon (EC) has the Solution

- Compatible to Flexible Materials
- Structured & Designed to Follow the Material Movement

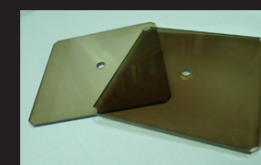


Bending S-DLC Coated Rubber

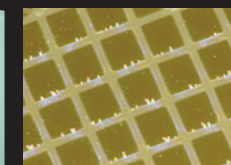


Enlarged View

- Compatible to Insulating Materials
- Able to Coat S-DLC at Low Temperature



Coated on Polycarbonate

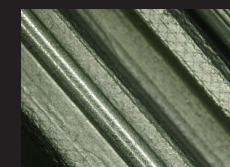


Augmented photo

- Compatible to Thermal Expansion Materials
- Structured & Designed to Expand with the base Material



Coated on Windshield Wiper



Augmented photo

Common Features of DLC

Firm

Bio-compatibility

Stain Resistant

Corrosion-Resistant

Gas Barrier

Chemical Resistant

Anti-Friction

Scratch Resistant

Smooth Surface

Antimicrobe

UV Cut

Inferred Permeability

High Transparency

Low Friction on other Materials

Ultra-Thin

S-DLC (eternal carbon) Film is nano thin

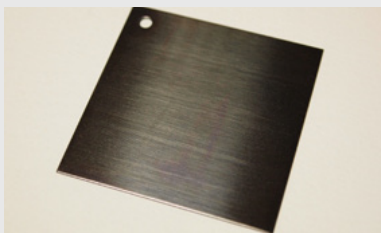
The distinctive feature of **eternal carbon** (S-DLC) from existing DLC is the film structure. This new DLC is structured into a tile formation enables to coat many materials which was incompatible to existing DLC.

Eternal Carbon is Tile Structured DLC which is an Amorphous Bind of Diamond and Graphite

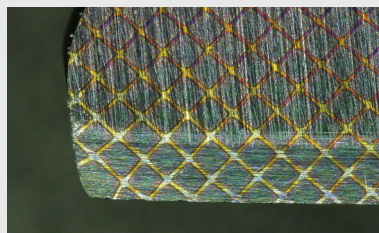
	Graphite	Diamond	eternal carbon DLC
Specific Gravity	2.25	3.52	1.0~3.0
Thermal Conductivity	0.4~2.1	1000~2000	0.2~30
Young' s modulus (GPa)	a=0.2456	a=03567	100~800
Hardness (Hv)	-	10000~12000	1500~2000
Temperature of Oxidation	400~450	600	300~500

Characteristics of Carbon Materials

Eternal Carbon is Compatible to Many Materials



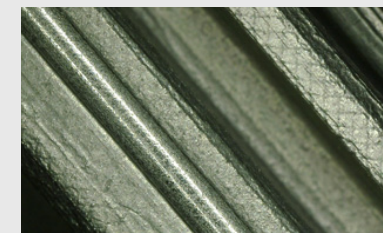
Stainless Steel



Stainless Steel (Enlarged View)

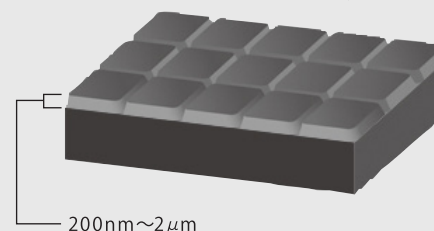


Wind-shield

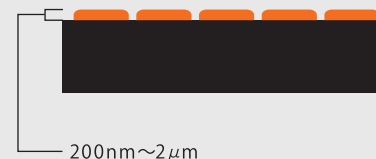
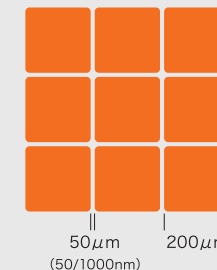


Wind-shield (Enlarged View)

This is how S-DLC is Structured



Surface 1μm=1/1000mm



The segment shown above is the basic size.

Size of the segment will differ from each material and requested fuction.

Please inform us your intended purpose, function and operation environment.

Durable Gain Durability to Metal Fatigue & Abrasion

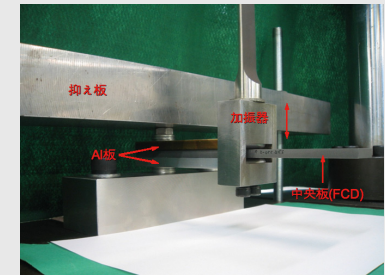
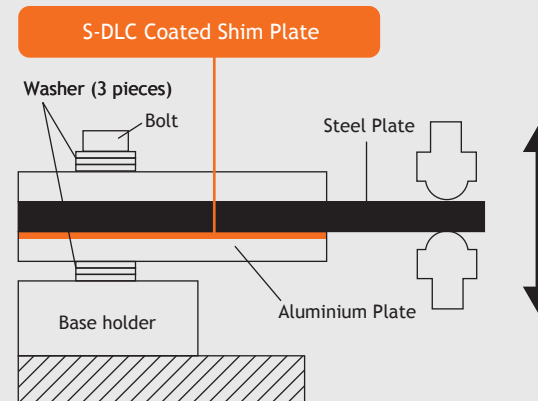
The fretting abrasion has been an eternal problem for engineer. And solving this problem by this new technology (S-DLC: Eternal Carbon), the impact to the industrial world is considerable.

Frictional wear between metal materials is a typical problem for industrial machinaries. The area of use is from transportation (airplanes, cars and trains), Robots (machinaries), construction machine (crane, digger and bulldozer) to electric power plant (thermal, hydroelectric and tidal).

Eternal Carbon is an advance technology to Solve the Fretting Abrasion.

- ◆ Gain durability of rubber, soft metal and many other plastics.

Fretting Abrasion Test

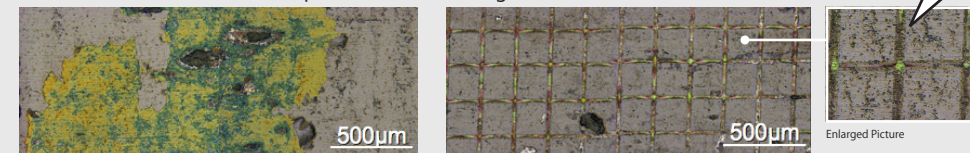


To examine the ability of EC, iMott have tested the fretting abrasion test (bending the plate for over 1million times.) The result of S-DLC was above our expectation

Test Sample After the Fretting Abrasion Test (1,000,000 times)



Eternal Carbon (S-DLC) has Improved from Existing DLC.



1. Durable to Base material movement by its unique segmented structure
2. Minimize the Exfoliation
3. Resistant to high bearing.
4. Traps in the ditches of the segment

Until the development of S-DLC, existing DLC was an extremely advanced material for coating conductors and flexible materials, such as steel, stainless-steel and other metal materials. But coating an insulator and flexible material was their weak point. S-DLC is the solution for these materials.

Flexible Adhere to Flexible Material

① Able to Coat on Insulator

One of the problems of existing DLC was coating on insulator. This was because of the electrostatic charge on the surface of the base material.

S-DLC has solved this problem by their unique coating process.

Atten: This unique process is the patent of iMott inc.

② Able to Coat on Flexible Material

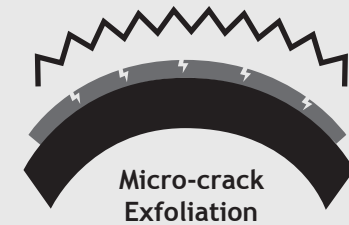
Please recognize that, as a molecule, S-DLC is not far different from existing DLC. They both structured by carbon & hydrogen. But as a material, S-DLC is far advanced because of its formation. DLC is a very hard material which is an amorphous band of diamond and graphite. But as a film, it is also very thin. And because of its special characteristic, DLC has been incompatible to flexible materials.

S-DLC has solved the problem by coating the DLC film into a segment form. This new segmented DLC is compatible to many flexible materials such as Rubber, Poly-carbonate and many other plastics.

Existing Technology

Existing C-DLC (Continuous DLC)

Existing Regular DLC



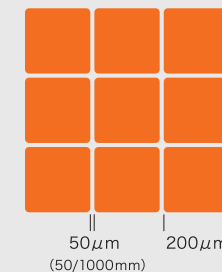
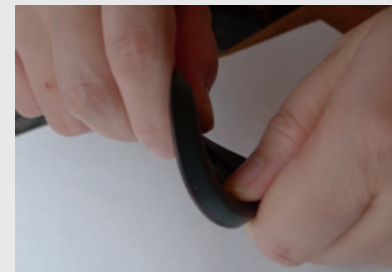
New Technology

S-DLC (Segmented DLC)

Segmented Structure



Sticks to the Base material



- S-DLC can stand 2 ~ 10 times more of deformation than existing DLC
- S-DLC extremely extends the duration and life time of rubber, softmetal and plastics.
- S-DLC extremely extends duration of life of rubber, softmetal and plastic surface.
- Able to change the size of the segment concerning the base material characteristic.

S-DLC (eternal carbon) has solved the fundamental problem of the existing DLC by simply structuring the DLC film into a micro tile form. This enables the DLC film to go along with the material expansion.

Every material has its own coefficient of expansion. DLC is a combination of Graphite & Diamond which has very low expansion rate. And because of this reason, Existing DLC was incompatible with many materials.

Tile formed S-DLC (eternal carbon) is highly compatible to expandable materials such as poly-carbonate, rubber and many other plastics. Atten: The ditch of S-DLC can easily expand

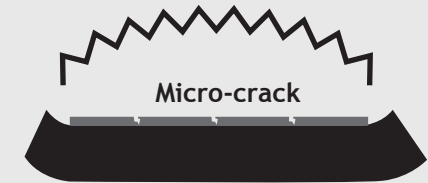
Expandable

Adhere to Thermal Expansion

Existing Technology

Existing C-DLC (Continuous DLC)

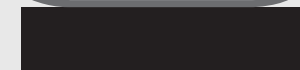
Existing Regular DLC



Micro-crack



Exfoliation



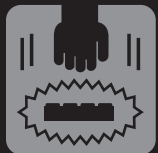
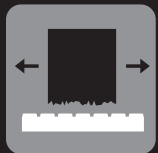
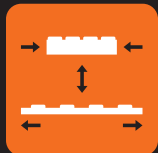
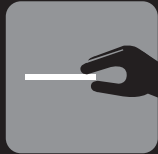
New Technology

S-DLC (Segmented DLC)

Segmented Structure



Expand along with the material



Every material has its own frictional rate. Specially few materials such as stainless-steel, steel, rubber, titanium, plastics have fairly large frictional rates.

Atten: The chart below shows the difference of the surface friction rate between DLC and other materials

Stainless Steel	Steel	Rubber	Titanium
0.5	0.5	2.0	0.7
Plastics	EC (S-DLC) ※1	F-EC ※2	Teflon
0.8	around 0.15	0.08	0.08

※1 EC = eternal carbon (S-DLC)

※2 FEC = eternal carbon + Fluororesin

Having High Friction Rate means...

Excess Energy Loss	Excess Temperature Loss
High Abrasion Rate	Excess Noise

Anti-friction

Reduce Friction rate

S-DLC is Superior in 3 Usages from Existing DLC

1. Extremely Tough in Abrasion

There are excess temperature and vibration on the surface of friction.

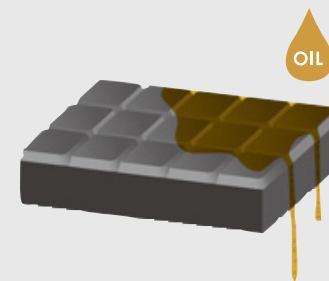
These factors are the cause of deformation of the material.

Existing DLC can easily peel off from these reasons.

2. Very low Friction Rate when Using Oil and other lubricants

The ditches of S-DLC enables to drain the abrasion powder and dust from the surface.

The surface friction rate will externally decline using oils and other lubricants.



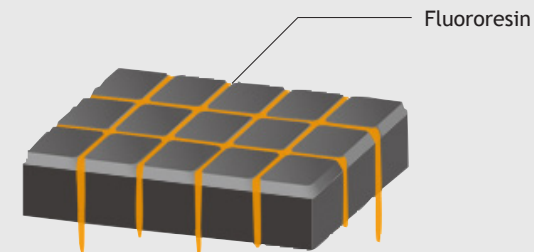
Prevents Abressive wear

Drain Abrasion Powder

3. Very low Friction Rate when Using Fluororesin (and other Solid Lubricants)

The ditches of S-DLC enables to drain the abrasion powder and dust from the surface.

The surface friction rate will externally decline using fluorosin and other solid lubricants.



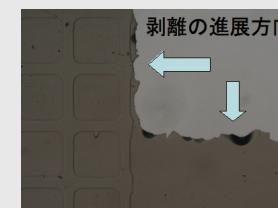
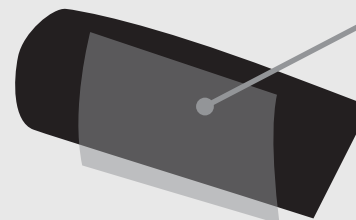
Existing DLC had a criticle problem in Exfoliation.



Exisiting Technology

100 times

Exisiting C-DLC (Continuous DLC)

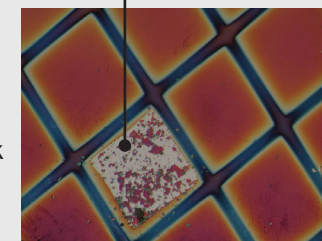
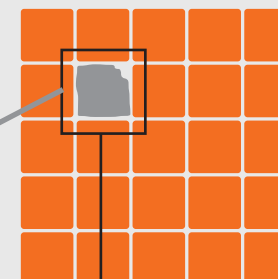
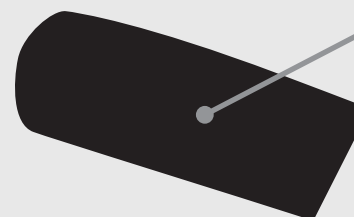


The exfoliation of the coating is partial on S-DLC

New Technology

S-DLC (Segmented DLC)

1600 times



The material of ec called DLC(Diamond like Carbon) is a very hard material. Like diamond, simply hardness does not mean that it is shock-resistant. An impact is one of the enemy to a certain material. DLC had the same problem for a long time. The Coating was too hard to stick on to the deformation of the base material.

S-DLC had solved this problem by its unique structue. Coating on a tough material surface, S-DCL was able to stand 16 times more than the existing DLC.

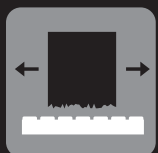
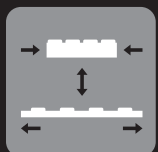
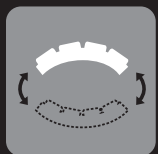
◆Can stand 2 to 10 times more difromation than exsiting DLC

◆The S-DLC segement structure enables to control exfoliation (the exfoliation of the coating is only partial)

Shock-resistant

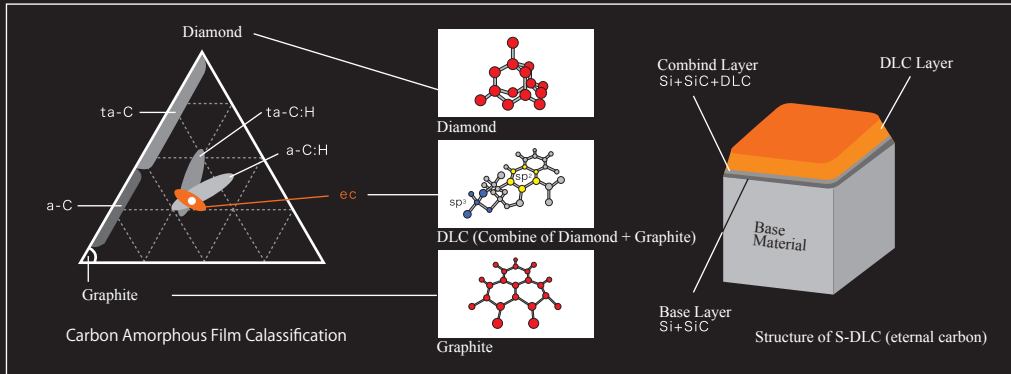
Gain Surface Intensity of the Material


The Micr-segmented DLC enables to stick to the deformation of the base material.



S-DLC Infomation

Coating Method	単パルス直流電源による化学的気相合成 方式
Coating Ingredient	テトラメチルシラン及びアセチレン
Coating Temprature	50～250℃
Thickness	0.1～20 μ m
Segment Size	50 μ m～3 m m
Hardness	HMv1000～2000 (10～20GPa)
Surface Firction Rate	0.04～0.2 (SF-DLC～C-DLC)
Expansion Rate	2.0～2.3 * 10 ^ -5 (m / k)





DC Pulse Plasma CVD

Machiine Information

Size : Differr from Customer Demand
(Our Machine: Internal Diameter is 900mmX900mmX900mm)

Electric : Main power source=6kW,
Exhauster=10kW, Control Device=5kW

Coating	Color	Hardness (HM v)	Corrosion Resistance	Oxidation Resistance	Seize Resistance	Adhesion
TiN	Gold	2000～2400	○	○	○	◎
ZrN	White Gold	2000～2200	○	△	△	○
CrN	White Silver	2000～2200	◎	○	◎	◎
TiC	White Silver	3200～3800	△	△	○	◎
TiCN	Purple ～ Gray	3000～3500	△	△	○	○
TiAlN	Purple ～ Black	2300～2500	○	◎	○	○

S-DLC (eternal carbon)is a DLC with an Additional Abilty.

	eternal carbon (S-DLC)	Exisiting DLC (DLC)
Duarbility	◎	△
Compatible with Expandable Material	◎	×
Compatible with Insulator	◎	×
Mutability of the Film	◎	×

I want a smooth surface
without oil or bearing



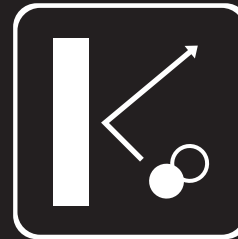
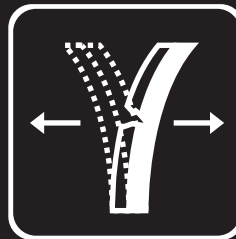
I don't want a defect, stain
nor scratch on the surface

I want to reduce the friction force
of the surface



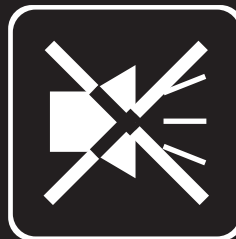
I want increase the durability
of the base material

I want to prevent fretting abrasion
of the metal



I want block the gas molecule
from the base material

I want to reduce the
squeaking sound of the friction



I want enlong the life time
of the base material

What is CR different from ordinary sales representative?

We will report
customer's voice
to improve our quality

We will explain
our technology
simply & easily to
our customer

We will definitely
decline to projects
that we cannot do

We will explain
with many pictures,
graphs and numbers

We will explain
only the fact

We will make our
best effort taking
time in customer
experience

We will manage our
customer information
at CR central control
center.

We will disclose our
CR staff evaluation

We will be responsible
to become the best
Customer Reporter

**CR Card is our Proof of
Authorized Sales Agent**

Valid Through **March/15/2014**
**Official eternal carbon
CUSTOMER REPORTER**



REPORTER No. 211200