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Tozero

TOTAL ZERO FRICTION

Shanghai Pioneering Surface Material Co.,Ltd.

Content

About Us >>

The Pioneering Surface Material Co., Ltd. is dedicated to a unique surface technology - ion-sulfurization & lubricating gradient material (LGM). With this cutting-edge approach, we deal with friction and wear in an unprecedented manner. Our goal is to boost quality level in products for our clients and reach stringent engineering and business scope in highly competitive environment.

Ion-sulfurization & LGM technology is being expansively adopted in relatively sliding and rotating parts made of steel, iron, copper, titanium, nickel, cobalt, molybdenum and relative alloys, tungsten carbide, and even carburized and nitrided steels. Engineering applications are composed of, but not limited to, automotive, hydraulics, die casting, machinery, tools, textiles, shipbuilding, metallurgy and other engineering branches with challenge in friction and wear.

Be Splendid >>

With 30+ years' full-power commitment in continuous innovation regarding surface processing engineering, we have been launched a unique friction/wear-resistance technology, which creates new engineering horizon for customers, and benefits our society due to its green-oriented and power-efficient characteristics.

◎ **Commercial Value**：
We provide an unprecedented technical package to counteract loss of lubrication, friction, wear, scuffing and seizure. This technology significantly reduces friction coefficient, improves lubricity, and enhances performance of metallic parts, molds, and tools. It also lengths service life of machines and automobiles.
Our technology leads in anti-friction/wear technologies. It improves product quality, reduces component cost, and increases productivity. Most of all, it helps our customers extend and maximize their market share. Its commercial impact conveys a vivid interpretation that technology is profit indeed.

◎ **Business Partners**
We treat our esteemed customer as business partner. We closely collaborate with each other in engineering and business. We build trust that permeates our collaboration. Our goal is to have our customers gain profound financial rewards via incorporating our technology.

◎ **Career**
We appreciate the values of our priceless treasure - our employees. We provide multiple platforms for their career growth. We all win via helping each other win.

◎ **Commitment to Our Society**
We bear the designation of society responsibility. Our advanced technology is energy-efficient and environment-friendly.

Innovating History >>

Regarding ion-sulfurization, LGM, and NanoMist technology, we possess 16 Chinese patents, 2 U.S. Patents, 10 European patents, and 2 Japanese Patents

◎ Our innovating path is technologically independent and adventurous

1981 Unprecedented ion-sulfurizing technology invented
1987 China patent awarded
1988 Japanese patent awarded
1991 European Patent (DE.FR.GB.IT.SE)awarded
1998 lubrication gradient material technology (LGM) invented
2000 Original LGM equipment built and certified by the State Administration of Machinery Industry
2002 U.S patent US6468679 awarded
2004 Chinese patent 98809509.2 awarded

2006 European patent(DE.FR.GB.IT.SE)EP1052306B1 awarded
2008 Shanghai Pioneering Surface Material Co., Ltd. founded
2010 Processing air conditioner compressor,heavy truck gearbox and hydraulic pump parts
2011 NanoMist Discharge technology developed
2012 Chinses patent ZL200810172701.8 awarded
2014 US patent US8795770 awarded
More to come……

State-of-the-art Technology

◎ Basis – Ion-sulfurization

In 1980s, a low-temperature ion-sulfurization technology was developed by our physicist Zhang Yifei. In this technology, ionized sulfur infiltrates into and reacts with metallic articles and a case composed of sulfides is formed. We call this physiochemical process ion-sulfurization.

◎ Breakthrough – Lubricating Gradient Material (LGM)

Ionized sulfur and other active elements proliferate into the metallic article and a layer with gradient composition and distinctive physical characteristics is formed, this layer is defined as lubricating gradient material (LGM). It can be regarded as an extension of ion-sulfurization.

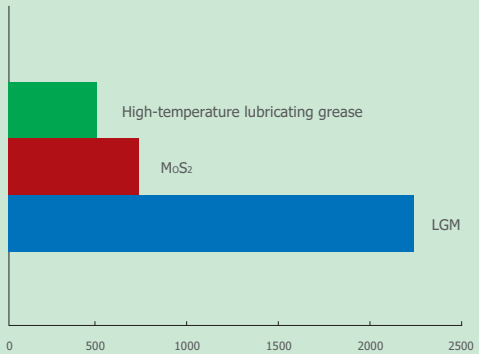
◎ Innovation – Mist-discharging technology – NanoMist

With a base on our ion-sulfurization and LGM technology, a milestone mist-discharging technology has been developed, in which the nano and micro scale compound particles suspend in the gaseous substrate and form a super-densely mist, with concentration thousands of times' higher than the relative gaseous state. A brand-new infiltrated case can thus be formed which maximizes friction resistance in the metallic articles, and extends the service life to a new level.

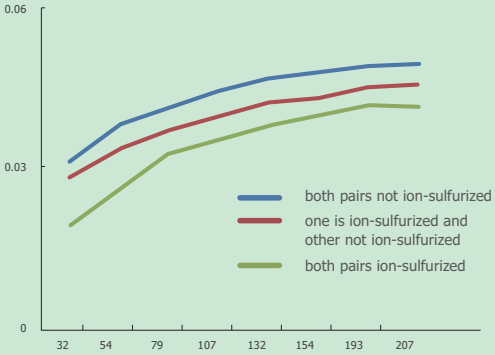
Advantages of Our Technology >>
Performance improvement >>

Wear morphology in steel parts with and without LGM

Surface characteristics of sliding shoes in air-conditioning compressor



Service temperature of LGM and other types of lubrications



Frictional coefficient of 1045 steel pairs

◎ Extraordinary wear resistance

Solid lubrication effect and low friction coefficient

Ion-sulfurized layer decreases friction coefficient and reduces friction power consumption.

Reduction in run-in time

Our technology reduces run-in time, alleviates adhesive seizure and scratch, dissipates friction heat, and lengths service life.

Features for micro-reservoirs to hold lubricant

Owing to its micro-porous feature, the ion-sulfurized and LGM layer holds a sustainable lubricant agent.

◎ Dynamic Protection

Self-lubricating effect

The sulfur continuously diffuses into the substrate and provides endurance in lubricating effect.

◎ High-temperature property

Low friction coefficient at elevated temperature

Under elevated temperature and/or radiating condition, the sulfurized article still maintains sound solid lubricating and wear-resistant disposition.

◎ A green technology

Little detrimental emission - low raw material consumption - high power efficiency.

◎ Benefit of non-destructive evaluation

Benefit of non-destructive evaluation

Open defects can be identified visually, which precludes extra cost in conventional dye penetration or magnetic powder inspection. This preventive approach helps avoid assembling flawed parts into machinery equipments and reduce latent maintenance cost.

◎ Geometry/dimension stability

Benefit of non-destructive evaluation

The whole LGM forming process is conducted at low temperature, with preservation of geometric precsion, and no side-effect of changing microstructure and hardness in substrate.

◎ Other engineering advantages

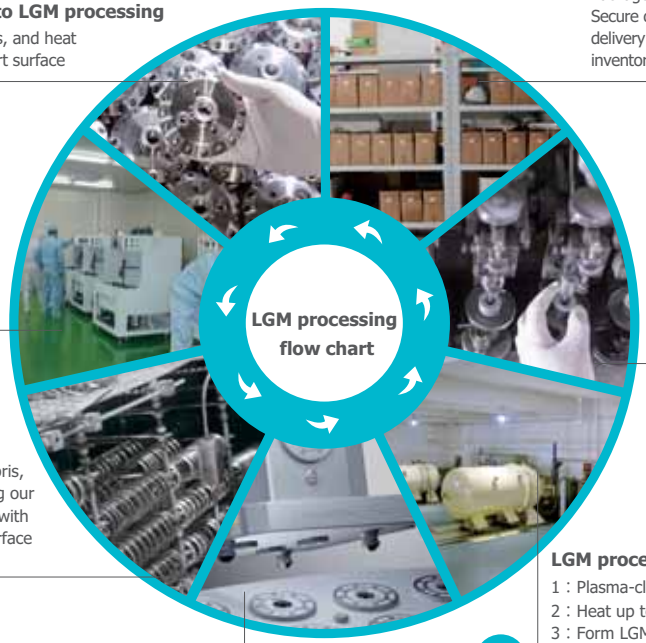
Improving contact fatigue condition

This technology lengths service life of parts under contact fatigue, and protects parts against fatigue crack.

◎ Benefit in productivity

It improves the overall reliability of unit and its functional efficiency, increases productivity, and reduces production cost. Commercially it garners extra profit as the time and cost for machinery maintenance is reduced.

Brief introduction to processing cycle >>



1

Inspection Prior to LGM processing

Rapidly inspect defects, and heat treatment flaws on part surface

2

Cleaning

Ultrasonically clean with water-base agent

3

Pre-processing

Eliminate adhered debris, dirts, and grease using our patented technology, with no damage to part surface

4

Loading/Framing

Load parts with multi-dimensional frame per geometry, dimension, and tolerance requirement

5

LGM processing

1 : Plasma-clean part surface
2 : Heat up to processing temperature
3 : Form LGM using our patented technology
4 : On-line non-destructive inspection

6

Quality Assurance and Inspection

Systematic and advanced inspection in hardness, dimension, tolerance, chemistry, and other items specified by client

7

Packaging and delivery

Package with specific materials. Secure quick turn-around with delivery reliability, and reduce inventory cost

Environment-friendly technology >>

We serve our society via committing to a green and energy-efficient technology.

Zero pollution /emission

During ion-sulfurization and LGM process, no hazardous gas, liquid and waste water is generated or emitted.

Cost reduction in raw materials

Service life of the ion-sulfurized part is enhanced profoundly, so that the need for raw materials and precious alloys drops.

Power/energy efficiency

Low-temperature reaction requires low energy consumption.

Due to marvelous gain in friction coefficient in LGM processed parts, efficiency of engine, transmission units, compressor, and hydraulic pump increases impressively, thus power and fuel consumption drops.

Business partners

◎ State-of-the-art solution for wear and friction

Our unique surface technology will upgrade the performance of Your machines, equipments, and vehicles. You will find that our service satisfies your very need in wear and friction resort, with respect to your specific applications.
Each year we process more than 120 millions parts used in vehicles, including one million sedans and 120 thousand heavy-load trucks. Besides, 70 thousand hydraulic pumps and engines are assembled with ion-sulfurized parts. We also process 320 thousand bearings and gears, and 80 thousand broaching and tapping tools per annum.

◎ Some of our esteemed customers:

SAIC MOTOR · SHANGHAI VOLKSWAGEN · Parker · SANY · LYC · DYNACAST · SHANGHAI GM · HONDA

Exemplary Applications

> Ships-final solution against seize in diesel engine

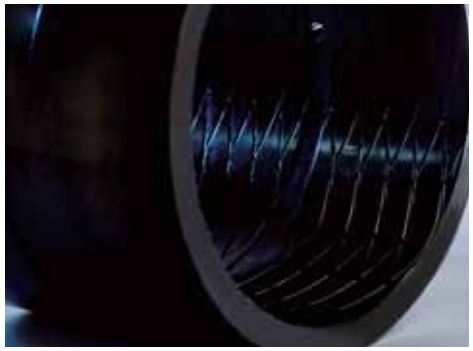
In the largest diesel engine manufacturer in China – Guangzhou Diesel Co., the engines it manufactured output power for 10K-ton cargo ships. During production evaluation, scaling and seizure occurred between busing cylinders, and bearing rollers and roller-pins, especially under super-rate and full-load running. In the most seriously damaged engine, 31 parts were replaced within one month!

Effect of LGM technology

The friction coefficient dropped in a large scale, and wear condition is overwhelmingly improved.

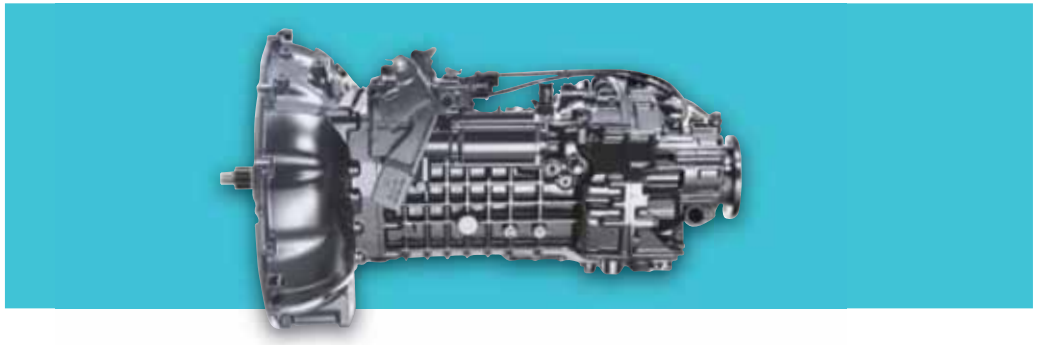
Seizure, scaling, and scuffing are eliminated completely.

Run-in pass ratio reaches 100%, compared to initial 20%.



◎ Automobile: Boost vehicle reliability, and decrease manufacturing cost

Strong friction and wear resistance of LGM parts contributes to vehicle reliability.
There is no need for post-sulfurization machining, and use of expensive metals and alloys can be reduced, thus manufacturing cost drops.
We are abound in experience in auto industry. We have been involved in development, design, and mass production for key auto parts. Our leading technology has established a sound role in dealing with challenges in lubrication and wear in vehicles.
Ion-sulfurization and LGM technology is being used in air-conditioner compressor, transmission unit, engine, driving axle, and steering unit.



> Air-conditioner compressor

The largest manufacturer of air-conditioners for vehicles in China incorporates our LGM technology in its compressors, in order to solve seizure and cold welding failures between sliding shoe and swashplate/piston.

Effect of LGM technology

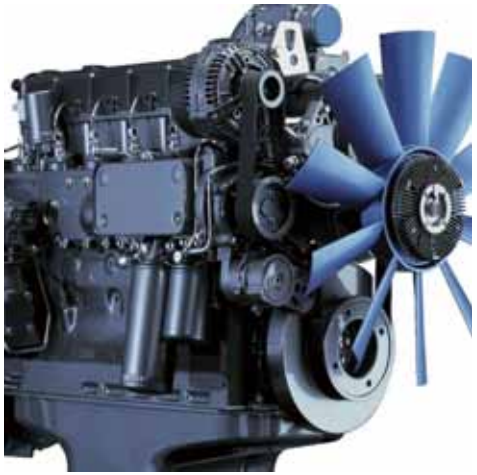
Seizure and cold welding in air-conditioner compressor was systematically overcome.
The average friction coefficient drops by 39.5%, and average friction power loss drops by 51.3%.
Service life of LGM parts increases by 1.5-3.4 times. Unit reliability is upgraded by 1.5 times.

> Transmission units in heavy-load trucks

In one Fortune-500 automobile enterprise – FAW Group, all heavy trucks are equipped with seven types of LGM processed parts, including limit washer, securing collar, and reversing gears.

Effect of LGM technology

Friction coefficient reduces by 29%-30%, area with wear marks is only 20% of original non-sulfurized counterparts.
LGM demonstrates great improvement in wear resistance, thermal stability, fatigue resistance, and assembly reliability, even under heavy load, high rotating rate, and harsh impact.
The transmission system with LGM parts passed 3-year 200,000-kilometer test under all driving conditions.
Due to its solid lubrication effect, LGM safeguards the vehicle under condition with limited or no addition of oil/grease lubricates.



> Automobile engine

The functionality of engine vitally governs the maneuverability of the vehicle.
In several auto makers, multiple components are being LGM processed, including piston ring, cylinder, crankshaft, camshaft, tappet, the valve and the rocker arm shaft.

Effect of LGM technology

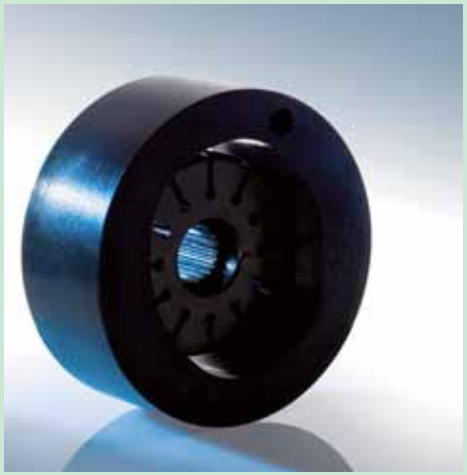
Great decease in run-in time: Only 23 hours' run-in stabilizes the friction power loss, while the non-LGM engine requires 74 hours!
Fuel efficiency and emission reduction: The average friction power loss drops by 4.7% in engine with LGM parts. Under high speed, it drops further to 7%.

> Diesel engine fuel injection system

In China's largest manufacturer of diesel engine fuel injection systems, - Wuxi Weifu Co., components in the fuel injection unit are LGM processed, in order to increase the functional reliability.

Effect of LGM technology

Services life: The service life of plunger couplers lengths by 3 times.
Wear resistance: Wear loss drops from 1.5μm /210-day to 0.8μm/210-day.
Manufacturing cost: The LGM processed windmill/case-tube can sharpen 1100 oil-delivery valve seats, compared to the original yield of 100 valve seats. LGM pneumatic taper-measuring head can gage 14,000 plunger cases, three times of original yield.



◎ Hydraulic power system: Improve coupling precision, lengthen service life, and suit more brands of oils

> Blade pump

We have been selected by one of the largest companies in motion controlling technology to be its surface technology supplier. We ion-sulfurize the stators, vanes, rotors, and blades.

Effect of LGM technology

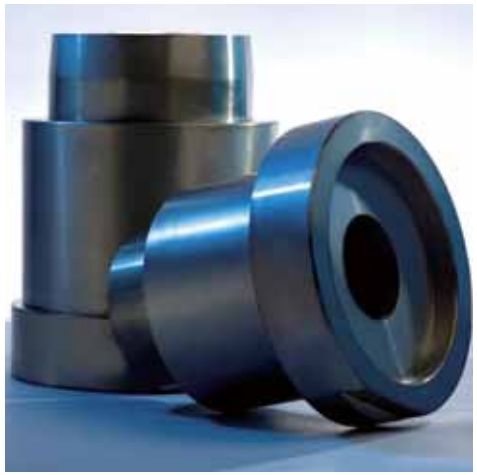
Run-in condition: friction coefficient decreases, and run-in condition improves.
Seizure and cold welding: Micro-porous surface holds a more sustainable lubricant oil/grease, and proofs seizure and scratch.
Service life: Service life of LGM processed pump core components is comparable to German ZF pump. Mass production has been launched.

> Plunger pump

Due to its simple structure, tight package, low noise level, high efficiency, long service life, and self-pumping function, axial plunger pump is used in lathe, forging, metallurgical, mining, and ship-building industries. It is also used in hydraulic power-transmission machineries.
We sulfurize slide pumps for dozens of customers.

Effect of LGM technology in sliding pump

Under high pressure and over-loading condition, no seizure between cylinder and plunger and liquid-distributing disk is encountered.
Friction temperature drops by 20% and power efficiency increases by 3.5%.



> Aluminum cast molds: Level up product quality, increase productivity, and reduce maintenance and downtime cost

The conventional cast molds for liquid aluminum deteriorate rapidly due to wear, fracture, and adhesion. The service life is short, downtime and repair cost is high.
With our innovative NanoMist process, the above bottlenecks in conventional molds have been broken through. In one world-famous precision part cast company, the key components in cast system are ion-sulfurized via NanoMist.

Effect of ion-sulfurization technology

No inter-metallic compound is formed between liquid aluminum and sulfurized molds.
It confers an effect of high wear resistance and easy die release on the molds, and there is no
high-temperature fatigue.
Friction coefficient decreases by 33%. Wear loss drops by 65%.
Productivity increases.
Downtime and maintenance cost drops
Product pass ratio is 20% higher.

> Hot roller: Improve wear resistance, reduce manufacturing cost

Hot roller is a critical component in steel manufacturing industry. 3-5kg rollers can be consumed for each Ton of steel output. Hot roller works under heavy load at a temperature of 800-1000℃, the service life is short. Capital Iron & Steel Company utilizes our technology to sulfurize their alloy and cast iron rollers.

Effect of LGM technology

Wear resistance increases.
Manufacturing cost drops, as roller replacement and maintenance cost decreases.
Productivity improves by 50-100%.
Downtime and maintenance decreases.

> Cold-work dies: Length service life, reduce surface roughness, improve product quality, and decrease expenditure in manufacturing

The bearing retainers and rollers in rolling bearings are cold stamped and pressed. The precision, durability, and service period impose a strong influence in product quality, yield, and cost. Some world-fame bearing manufacturers process their molds using our LGM technology.

Effect of LGM technology

Service life of dies is boosted by 100%, from 5000 pieces per die, to 10170 pieces per die.
Surface smoothness improves.
Product quality improves due to high precision of LGM processed dies.
Downtime and repair cost is extensively reduced.

> Broaching and tapping tools – milestone improvement in property and effciency

Background: Collaborated with one distingushed tool manufactuer, we have developed LGM spline broaches, involute spline broaches, hollow center taps and successfully overcome drawbacks encountered in low alloy steels under low-speed cutting, like very limited operation life, poor smoothness, and chip build-up. Those sulfurized tools can be used in a variety of metals – low-carbon steels, aluminum, titanium, copper and stainless steels.

Effect of LGM technology

Cutting efficiency: Chip curling improves, and cutting efficiency and speed increases
Service life: Operation period is enhanced by 30-100%.
Smoothness: Ostensibly better surface quality is yielded.
Tool property: One single broaching pass can be as long as 1.8 meters (6 ft).