semicera

Chaging How Material Are Made

SEMI-CERA

SEMICONDUCTOR

Striving for Semiconductor Coating Leadership

Content

01

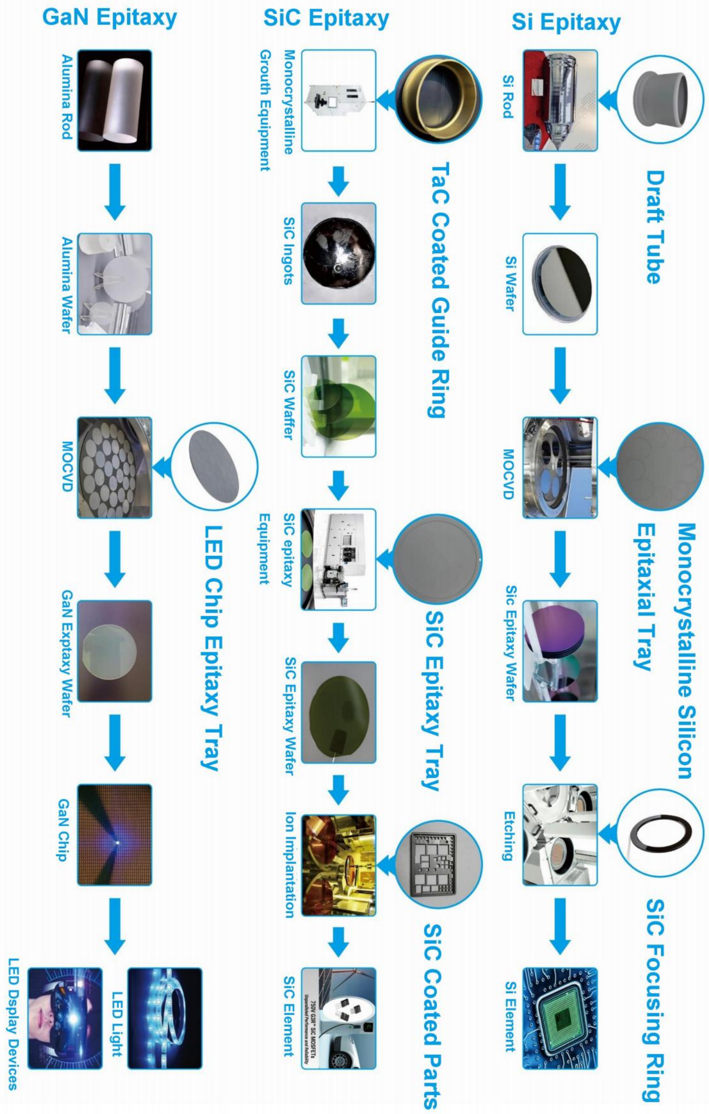
ABOUT SEMI-CERA TECH

Striving for Semiconductor Coating Leadership

Coating Materials for Multiple Semiconductor Applications

Semicera Semiconductor (Ningbo Miami Advanced Technology Co., Ltd.,) based in Ningbo, Zhejiang Province, China, was established in January 2018. Our mission is to shape the future through materials, and our vision is to become a leading new materials company with core technologies in the semiconductor field. We specialize in the research and development of advanced technologies such as SiC coatings, Tac coatings, pyrolytic carbon coatings, CVD SiC (Solid SiC), and recrystallized silicon carbide, which are critical for the semiconductor industry. We also focus on the large-scale production of high-purity material products.

Overview of the Semiconductor Chip Epitaxy Industry Chain



02 Surface Coating Product

CVD SiC Coating

Silicon carbide(SiC) epitaxy

The epitaxial tray, which holds the SiC substrate for growing the SiC epitaxial slice, placed in the reaction chamber and directly contacts the wafer.

The upper half-moon part is a carrier for other accessories of the reaction chamber of SiC epitaxy equipment. It is temperature-controllable and installed in the reaction chamber without direct contact with the wafer.

The lower half-moon part is connected to the quartz tube, introducing the gas to drive the susceptor base to rotate. It is temperature-controllable and installed in the reaction chamber without direct contact with the wafer.

表面涂层产品

CVD碳化硅涂层

CVD Silicon Carbide(SiC) Coating

MOCVD外延

MOCVD epitaxy

4寸外延基座，放置4寸衬底，用于生长LED用蓝绿光外延片，装在反应腔内，直接接触晶圆.

4-inch epitaxial base is used to place 4-inch substrates, which is used to grow blue-green epitaxial slice for LEDs. It is installed in the reaction chamber and directly contacts the wafer.

2寸外延基座，放置2寸衬底，用于生长深紫外LED的外延片，装在反应腔内，直接接触晶圆.

2-inch epitaxial base is used to place 2-inch substrates and is used to grow epitaxial slice of deep ultraviolet LEDs. It is installed in the reaction chamber and directly contacts the wafer.

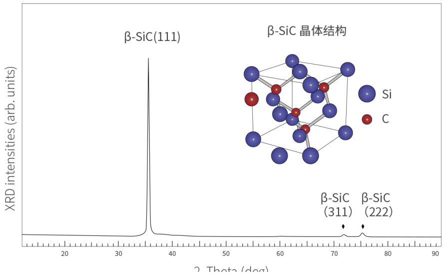
Si基GaN外延

Si based GaN epitaxy

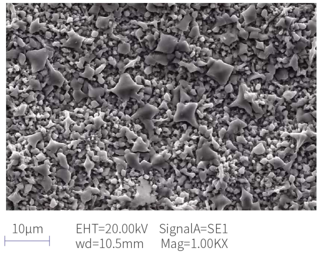
外延托盘，放置Si衬底，装在反应腔内，直接接触晶圆，通过化学气相沉积或分子束外延等方法沉积氮化镓薄膜，实现硅基材料和氮化镓材料的有机结合，主要应用于光电子器件，电力电子器件，太阳能电池等领域.

An epitaxial susceptor is used to place on a Si substrate in a reaction chamber and directly contacts the wafer. GaN thin films are deposited through methods such as chemical vapor deposition or molecular beam epitaxy to achieve organic combination of silicon based materials and gallium nitride materials. It is mainly used in fields such as optoelectronic devices, power electronic devices, solar cells, etc

CVD SiC 薄膜晶体结构为面心立方结构
薄膜生长取向接近百分之百（111）



CVD SiC 薄膜 SEM 数据，
晶体大小在 2~10μm



CVD SiC 薄膜基本物理性能 Basic physical properties of CVD SiC films	
性质 / Property	典型数值 / Typical Value
晶体结构 / Crystal Structure	FCC β phase 多晶，主要为（111）取向
密度 / Density	3.21 g/cm^3
硬度 / Hardness	2500 维氏硬度（500g load）
晶粒大小 / Grain SiZe	2~10μm
纯度 / Chemical Purity	99.99995%
热容 / Heat Capacity	640 J·kg^{-1}·K^{-1}
升华温度 / Sublimation Temperature	2700℃
抗弯强度 / Flexural Strength	415 MPa RT 4-point
杨氏模量 / Young' s Modulus	430 Gpa 4pt bend, 1300℃
导热系数 / Thermal Conductivity	300W·m^{-1}·K^{-1}
热膨胀系数 / Thermal Expansion(CTE)	4.5×10^{-6}K^{-1}

烧结碳化硅物理特性 Physical properties of Sintered Silicon Carbide	
性质 / Property	典型数值 / Typical Value
化学成分 / Chemical Composition	SiC>95%, Si<5%
体积密度 / Bulk Density	>3.07 g/cm^3
显气孔率 / Apparent porosity	<0.1%
常温抗弯强度 / Modulus of rupture at 20℃	270 MPa
高温抗弯强度 / Modulus of rupture at 1200℃	290 MPa
硬度 / Hardness at 20℃	2400 Kg/mm^2
断裂韧性 / Fracture toughness at 20%	3.3 MPa · m$^{1/2}$
导热系数 / Thermal Conductivity at 1200℃	45 w/m .K
热膨胀系数 / Thermal expansion at 20-1200℃	4.5 1 ×10^{-6}/℃
最高工作温度 / Max.working temperature	1400℃
热震稳定性 / Thermal shock resistance at 1200℃	Good

重结晶碳化硅物理特性 Physical properties of Recrystallized Silicon Carbide	
性质 / Property	典型数值 / Typical Value
使用温度 / Working temperature (°C)	1600°C (with oxygen), 1700°C (reducing environment)
SiC 含量 / SiC content	> 99.96%
自由 Si 含量 / Free Si content	< 0.1%
体积密度 / Bulk density	2.60-2.70 g/cm^3
气孔率 / Apparent porosity	< 16%
抗压强度 / Compression strength	> 600 MPa
常温抗弯强度 / Cold bending strength	80-90 MPa (20°C)
高温抗弯强度 Hot bending strength	90-100 MPa (1400°C)
热膨胀系数 / Thermal expansion @1500°C	4.70 10^{-6}/°C
导热系数 / Thermal conductivity @1200°C	23 W/m•K
杨氏模量 / Elastic modulus	240 GPa
抗热震性 / Thermal shock resistance	Extremely good

热解炭涂层
Pyrolytic Carbon Coating

热解碳涂层是利用化学气相沉积(CVD)工艺在高度纯化的各向同性石墨的表面覆一层热解碳薄层，它具有高密度、高纯度和热、电、磁、力学性能各向异性。

Pyrolytic carbon coating is a thin layer of pyrolytic carbon coated on the surface of highly purified isostatic graphite using chemical vapor deposition (CVD) technology. It has high density, high purity, and anisotropic thermal, electrical, magnetic, and mechanical properties.

主要特点 Main features

表面致密，无气孔。
The surface is dense and free of pores.

纯度高，气密性好。
High purity,good airtightness.

耐高温，强度随使用温度升高而增加，2750℃时强度达到最高値3600℃升华。
High temperature resistance, strength increases with increasing usage temperature, reaching the highest value at 2750 ℃,sublimation at 3600 ℃.

弹性模量低，导热率高，热膨胀系数小，优良的抗热震性能。
Low elastic modulus, high thermal conductivity, low thermal expansion coefficient, and excellent thermal shock resistance.

化学稳定性好，耐酸、碱、盐及有机试剂，对熔融金属、炉渣和其他腐蚀性介质均不起作用，在大气中400℃以下氧化不明显，800℃时氧化速度明显增加。
Good chemical stability, resistant to acid, alkali, salt, and organic reagents, and has no effect on molten metals, slag, and other corrosive media. It does not oxidize significantly in the atmosphere below 400 ℃, and the oxidation rate significantly increases at 800 ℃.

高温下不放任何气体，在1800℃左右能维持10-7mmhg的真空。
Without releasing any gas at high temperatures, it can maintain a vacuum of 10-7mmHg at around 1800 ℃.

产品应用 Product application:

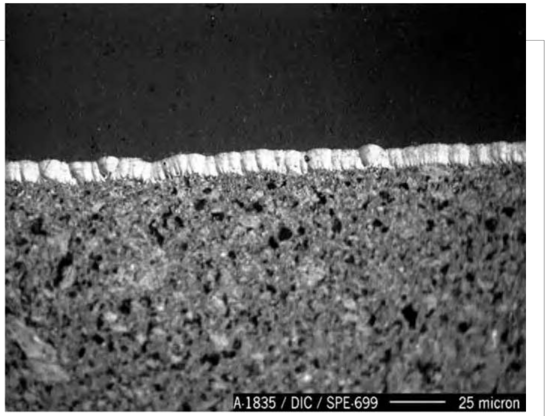
半导体行业中，蒸铝用的熔炼坩埚。
Melting crucible for evaporation in semiconductor industry

大功率电子管栅极。
High power electronic tube gate.

接触调压器的电刷。
Brush that contacts the voltage regulator.

X - 线和中子衍用的石墨单色器
Graphite monochromator for X-ray and neutron

各形状的石墨基体及原子吸收管涂层
Various shapes of graphite substrates and atomic absorption tube coating.

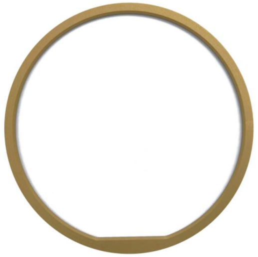


500X显微镜下的热解碳涂层效果，表面完好密封
Pyrolytic carbon coating effect under a 500X microscope, with intact and sealed surface.

CVD碳化钽涂层
CVD Tantalum Carbide Coating

TaC涂层是新一代耐高温材料，具有比SiC更好的高温稳定性，作为耐腐蚀涂层、抗氧化涂层、耐磨涂层，可在2000℃以上环境中使用，广泛应用于航空航天超高温热端部件、第三代半导体单晶生长等领域。

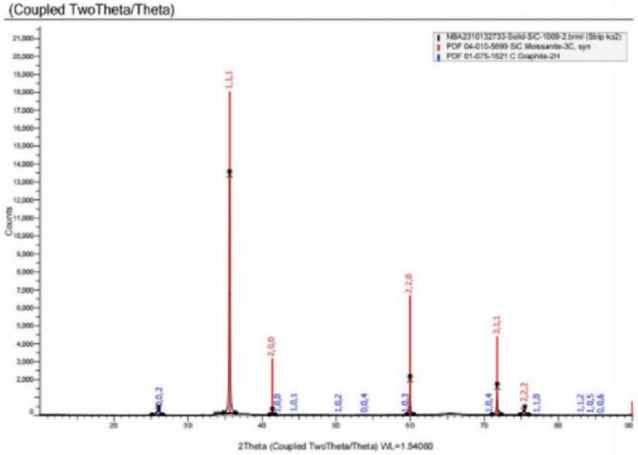
TaC coating is the new generation high temperature resistant material, with better high temperature stability than SiC. As a corrosion-resistant coating, anti-oxidation coating and wear-resistant coating, can be used in the environment above 2000℃, widely used in aerospace ultra-high temperature hot end parts, the third generation semiconductor single crystal growth fields.



碳化钽涂层物理特性物理特性 Physical properties of TaC coating	
密度 / Density	14.3 (g/cm³)
比辐射率 / Specific emissivity	0.3
热膨胀系数 / Thermal expansion coefficient	6.3 10^{-6}/K
努氏硬度 / Hardness (HK)	2000 HK
电阻 / Resistance	1×10^{-5} Ohm*cm
热稳定性 / Thermal stability	<2500℃
石墨尺寸变化 / Graphite size changes	-10~-20um
涂层厚度 / Coating thickness	≥20um typical value (35um±10um)

Solid Silicon Carbide(CVD SiC)

Solid CVD SILICON CARBIDE parts are recognized as the primary choice for RTP/EPI rings and bases and plasma etch cavity parts that operate at high system required operating temperatures (> 1500°C), the requirements for purity are particularly high (> 99.9995%) and the performance is especially good when the resistance to chemicals is particularly high. These materials do not contain secondary phases at the grain edge, so their components produce fewer particles than other materials. In addition, these components can be cleaned using hot HF/HCl with little degradation, resulting in fewer particles and a longer service life.



03

High-purity, High-temperature Resistant Products for Semiconductors

High Purity Silicon Carbide Products

SiC Wafer Boat

SiC vertical wafer boat

SiC horizontal wafer boat

SiC horizontal square wafer boat

SiC LPCVD wafer boat

SiC horizontal plate boat

SiC round wafer boat

Silicon carbide wafer boat is a load-bearing device for wafers, mainly used in solar and semiconductor diffusion processes. It has characteristics such as wear resistance, corrosion resistance, high-temperature impact resistance, resistance to plasma bombardment, high temperature bearing capacity, high thermal conductivity, high heat dissipation, and long-term use that is not easy to bend and deform. Our company uses high-purity silicon carbide material to ensure service life and provides customized designs, including various vertical and horizontal wafer boat.

High Purity Silicon Carbide Products

SiC Paddle

The silicon carbide cantilever paddle is mainly used in the (diffusion) coating of silicon wafers, which plays a crucial role in the loading and transportation of silicon wafers at high temperature. It is a key component of semiconductor wafer loading systems and has the following main characteristics:

1. It does not deform in high temperature environments and has a high loading force on the wafers;
2. It is resistant to extreme cold and rapid heat, and has a long service life;
3. The thermal expansion coefficient is small, greatly extending the maintenance and cleaning cycle, and significantly reduce pollutants.

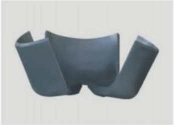
SiC Furnace Tube

Silicon carbide process tube, made of high-purity SiC without metallic impurities, does not pollute the wafer, and is suitable for processes such as semiconductor and photovoltaic diffusion, annealing and oxidation process.

SiC Robot Arm

SiC robot arm, also known as wafer transfer end effector, is a robotic arm used to transport semiconductor wafers and is widely used in the semiconductor, optoelectronic, and solar energy industries. Using high-purity silicon carbide, with high hardness, wear resistance, seismic resistance, long-term use without deformation, long service life,etc., can provide customized services

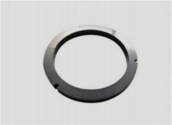
Graphite for crystal growth



Graphite three-petal crucible

Graphite heater

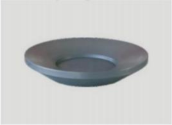
Graphite guide tube



Graphite ring

Graphite heat shield

Graphite electrode tube



Graphite deflector

Graphite chuck

All processes used for growing semiconductor crystals operate in high-temperature and corrosive environments. The hot zone of the crystal growth furnace is usually equipped with heat-resistant and corrosion-resistant high purity graphite components, such as graphite heaters, crucibles, cylinders, deflector, chucks, tubes,rings, holders,nuts,etc. Our finished product can achieve an ash content less than 5ppm.

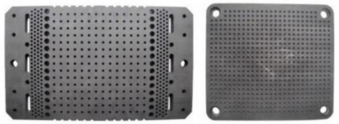
Graphite for Semidonductor Epitaxy


Graphite base


Graphite epitaxial barrel

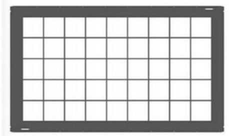

Monocrystalline silicon epitaxial base


MOCVD graphite parts


Semiconductor graphite fixture

Epitaxial process refers to the growth of a single crystal material on a single crystal substrate with the same lattice arrangement as the substrate. It requires many ultra-high purity graphite parts and graphite base with SIC coating. The high purity graphite used for semiconductor epitaxy has a wide range of applications, which can match most commonly used equipment in the industry. At the same time, it has extremely high purity, uniform coating, excellent service life, and extremely high chemical resistance and thermal stability.

Insulation Material and other


C/C carbon frame


Graphite hard felt cylinder


Graphite hard felt customized parts


Graphite soft felt


Carbon carbon composite parts


Graphite foil

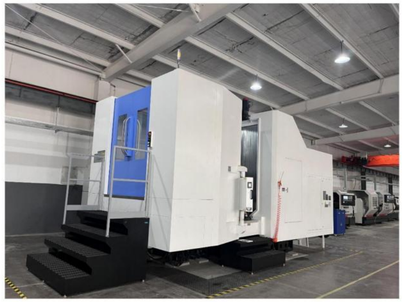
Thermal insulation materials used in semiconductor production are graphite hard felt, soft felt, graphite foil, carbon composite materials, etc. Our raw materials are imported graphite materials, which can be cut according to the specification of customers, and can also be sold as a whole. Carbon composite material is usually used as a carrier for solar monocrystal and polysilicon cell production process .

04 Value-added Services

Machinery Capability

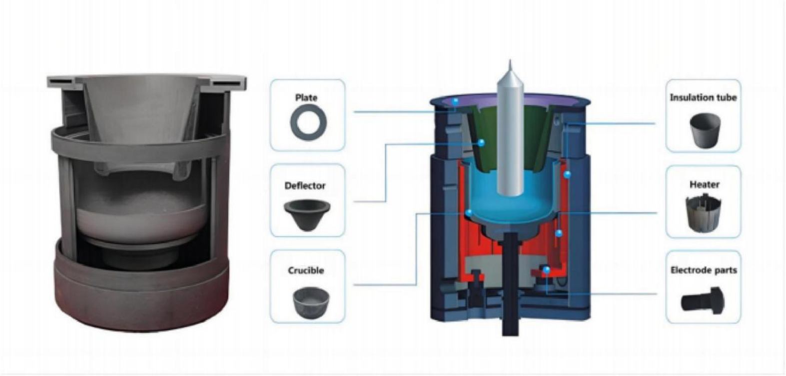
Semicera Semiconductor has a leading semiconductor field of graphite, silicon carbide and other machining capabilities and experience, can meet customers for semiconductor products of high precision, high purity, high quality and other processing needs. The tools we use, the cutting process and the choice of materials are also carefully optimized to achieve micron size control and high surface quality. We pay attention to quality control and process optimization in the processing process, real-time monitoring and control of key parameters in the processing process to ensure product consistency and stability. We also implement a strict quality management system to ensure that products are processed in accordance with customer requirements and industry standards, and carry out comprehensive quality inspection.

We will continuously invest in equipment improvement and technological innovation to meet the growing needs of our customers and provide them with superior solutions and support.

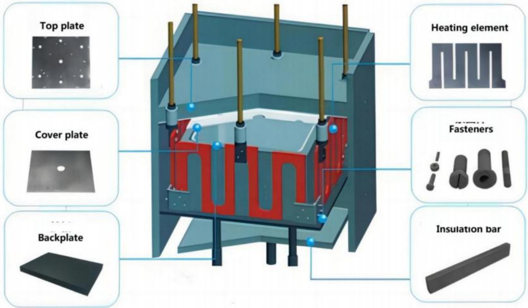


Solution of Thermal Field Modification

In terms of thermal field design and transformation, our company can complete the design and batch supply to Czochra single crystal, casting polycrystal, gallium arsenide, zinc selenide, sapphire, silicon carbide and other different industry equipment. At the same time, for the mechanical thermal calculation of various structures, components and atmospheres under different high temperature environments, we also have professional modeling and simulation computing capabilities, which can provide customers with professional design optimization programs and suggestions.



monocrystalline furnace thermal field



polycrystalline furnace thermal field

Facilities and Laboratories

CVD High Temperature Furnace

Coating substrates for LED chip epitaxy, silicon wafer epitaxy, third-generation semiconductor epitaxy substrates and components, TaC coatings, and more.

Vacuum Purification Furcace

Purification of carbon-based elements such as graphite, carbon felt, graphite powder, and carbon composite.

Horizontal Graphitization Furnace

Primarily employed for high-temperature treatment of carbon materials, such as sintering and graphitization of carbon materials, graphitization of PI film, sintering of thermal conductive materials, sintering and graphitization of carbon fiber ropes, graphitization of carbon fiber filaments, purification of graphite powder, and other materials suitable for carbon environment graphitization.

CNC machines

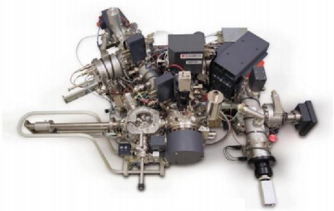
CNC machines

Testing equipment

CTE Test Instrument

GDMS

Four-Prode Instrument



SIMSSIMS

Laser Themal
Conductivity instrument

Coating Material
Development and
Verrification Equipment

Coordinate Measuring Machine

Device that confirms levelness by measuring X/Y/Z

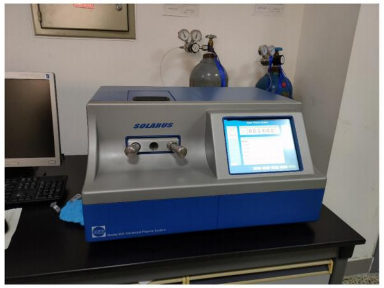
Purification Services

Our service covers the purification and mapping of a wide range of semiconductor materials, with the aim of delivering high-quality semiconductor materials for various applications. Leveraging our advanced purification technology and state-of-the-art equipment, we effectively eliminate impurities, thereby enhancing the purity of semiconductor materials. Our purification process is meticulously designed, incorporating multiple steps and strict quality control measures to ensure exceptional purity and stability of the materials we offer.

Additionally, we are dedicated to providing our customers with precise and reliable mapping services. Equipped with advanced testing equipment and instruments, and supported by a team of experienced professionals, we are capable of conducting comprehensive measurements and analyses of semiconductor material characteristics. Our mapping services encompass a wide range of tests, including electrical properties, composition, purity, physical properties, and thorough investigations into material structure and composition. Through meticulous mapping, we gather detailed data and information, enabling us to provide customers with accurate assessments of material characteristics and relevant recommendations.

Provide Costom Semicondutor Testing Kit

We are committed to providing various semiconductor thermal field product test kits to meet the different needs of customers. Our testings cover a wide range of semiconductor materials, including silicon carbide, graphite, tantalum carbide, etc., for comprehensive testing of the electrical properties, composition, purity, physical properties, size, and crystal structure. These testing kits are designed and manufactured by a professional team, equipped with advanced testing equipments and instruments to ensure high accuracy and reliability. Our product testing kits not only provides a comprehensive testing plan, but also includes detailed testing reports and analysis to help customers understand the performance and potential issues of the product.



Honor and Certification

荣誉证书

"浙技科技科技科技有限公司" 顺利入选为"浙江省集成电路创新指南企业"会员。

特发此证，以此鼓励！

二零二三年四月

荣誉证书

2021 "创芯中国" 集成电路创新挑战赛

总决赛 三等奖

特发此证，以资鼓励！

萬泰認證

CERTIFICATE OF REGISTRATION

This is to certify that the Management System established by

Zhejiang LiuFang Advanced Carbon Technology Co., Ltd.

GB/T19001-2016 idt ISO9001:2015

萬泰認證

认证证书

浙江六方碳素科技有限公司

GB/T19001-2016 idt ISO9001:2015

浙江省科技型中小企业

证书

企业名称：

证书编号：

Partners

HC SEMITEK

三安光电 San'an Optoelectronics

乾照 CHANGELIGHT

UV LEDTEK

AMTC SHENZHEN MTC CO.,LTD

圆融科技

FOCUS LIGHTINGS 聚灿光电

Silan Azure

IC chip epitaxy

JRH 金瑞泓 QL ELECTRONICS

晶睿 JINRAY

普兴电子 POSHING

JSG

XINWEI

Third generation semiconductor

瀚天天成 电子科技(厦门)有限公司 EpiWorld International Co., Ltd.

CorEnergy®

BYD

HOSHINE 宁波合盛新材料有限公司

普兴电子 POSHING

SONGSHAN LAKE MATERIALS LABORATORY 松山湖材料实验室

CECS 中电化合物