4934 Tainergy Report

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Outline

1. Company Profile & Financial Report
2. Summary of 3 BUs
3. SiC Application & Market
4. SiC Substrate Process
5. Conclusions

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Company Profile

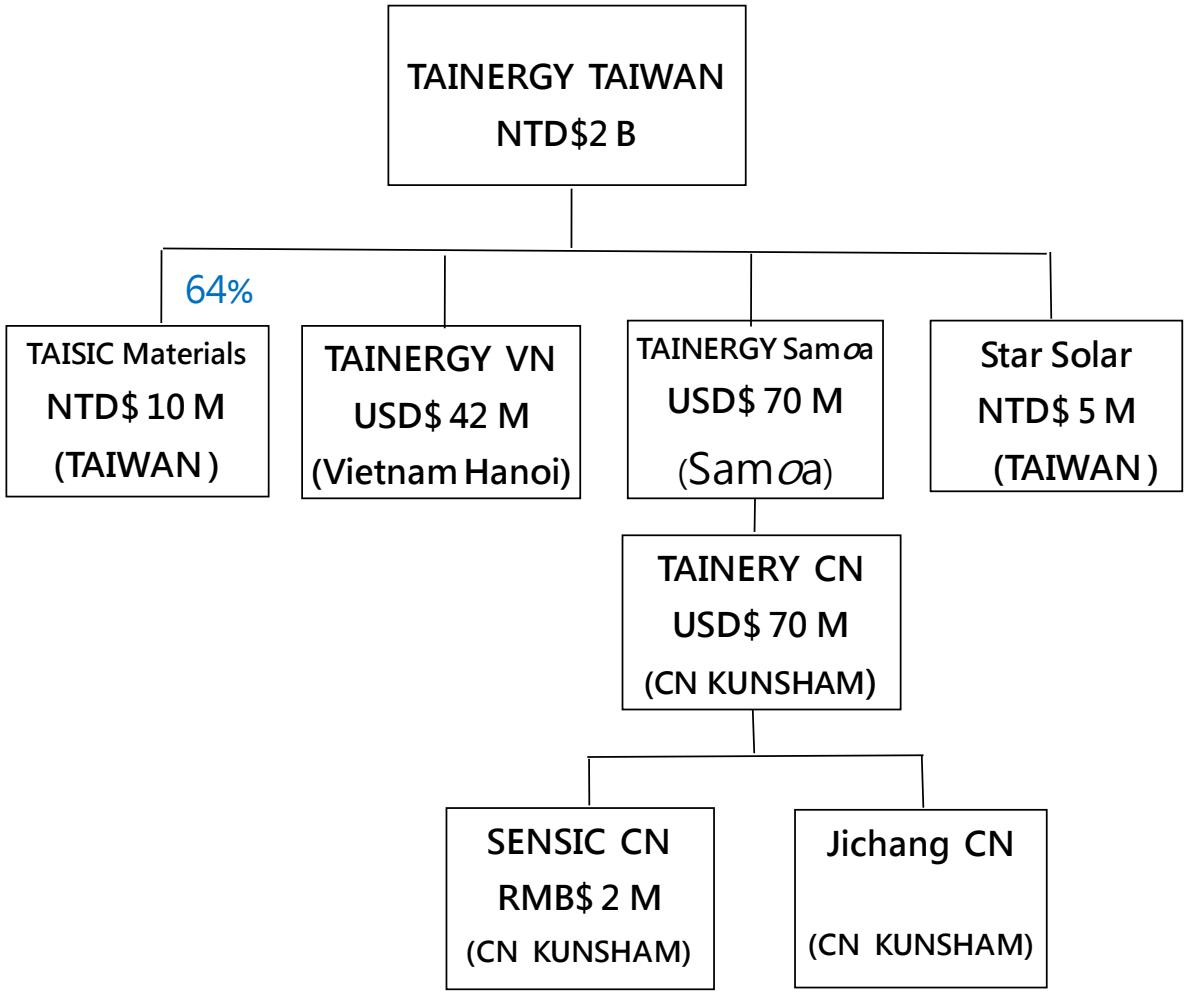
- Established : 2007/5/14
- Capital： NTD 2 Bil.
- Major Investor：Kenmec

  Shareholding %：28.83%
- IPO：Aug. 2011

  (TSEC：4934)
- Major Product：Solar Cells, PV

  System

Organizational Chart



Balance Sheet

In NT$ Millions

category	2018	2019	2020/6/30
Cash & Cash equivalents	584	607	786
Receivables	545	218	21
Inventory	153	77	85
Current Assets	2,269	1,451	1,387
Non-Current Assets	2,775	2,719	2,113
Total asset	5,044	4,170	3,500
Current Liabilities	2,048	1,531	1,206
Long-term interest-bearing Debts	670	841	472
Total debt	2,718	2,372	1,678
Capital-common stock	3,565	2,000	2,000
Additional paid-in capital in excess of par	1,052	795	795
Retained earnings	(1,834)	(484)	(432)
Other	(457)	(512)	(545)
Shareholders' equity	2,327	1,799	1,818

Book Value Per Share:	6.5	9.0	9.1
Current ratio:	111%	95%	115%
Debt ratio:	54%	57%	48%

Income Statement

In NT$ Millions

category	2018	2019	2020 H1	2020Q1	2020Q2
After tax EPS	(5.17)	(2.42)	0.26	(0.04)	0.30
Net Sales	2,727	2,329	1,068	502	566
Gross Profit	(802)	(120)	199	43	156
Operating Expense	322	210	120	55	65
Operating Profit	(1,124)	(330)	79	(13)	92
Other Income/Expense	(615)	(180)	(35)	2	(37)
Profit Before Tax	(1,739)	(510)	44	(11)	55
Income Tax Expense	(105)	26	8	3	5
Net Income	(1,844)	(484)	52	(8)	60

Gross Margin	(29.4%)	(5.1%)	18.6%	8.5%	27.6%
Expense Margin	11.8%	9.0%	11.3%	10.9%	11.4%
Operating:	(41.2%)	(14.2%)	7.4%	(2.6%)	16.2%
Profit Before Tax Margin	(63.8%)	(21.9%)	4.1%	(2.3%)	9.6%
Net Profit Margin	(67.6%)	(20.8%)	4.9%	(1.6%)	10.5%

Cash Flows

In NT$ Millions	2018	2019	2020 H1
cash from operating activitie:	(313)	416	573
cashfrom investing activities	(478)	55	(126)
cash from financing activities	420	(415)	(255)
others	1	(33)	(13)
net cash flow	(370)	23	179
beginning balance	954	584	607
ending balance	584	607	786

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3 BU of Tainergy

- Solar Cells
- PV System
- SiC

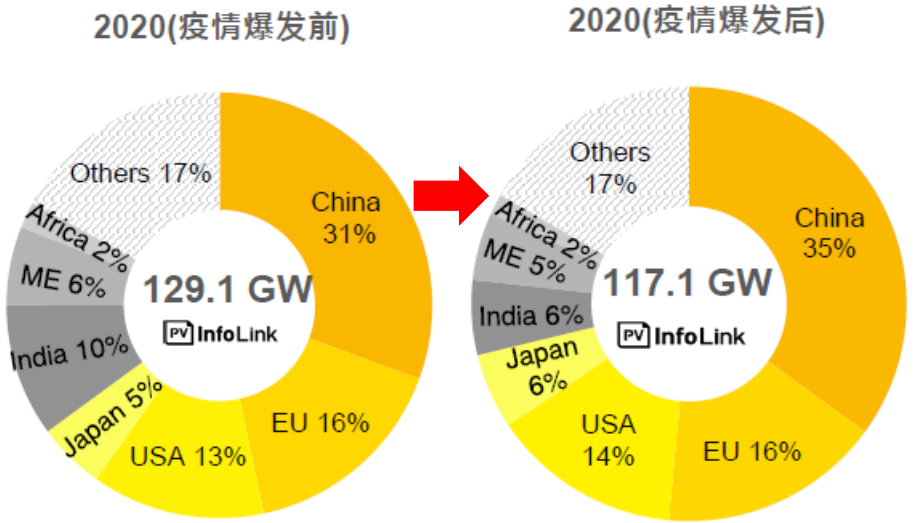
Solar Cells BU

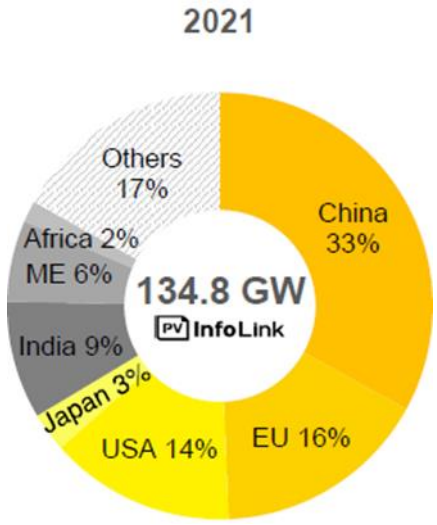
- Factory centralized in Vietnam
- Major products: Bi-facial Mono PERC and Multi cells
- Target capacity in 2020: **800MW**,

  including 500 MW mono and 300MW multi

Review and Prospect of PV market

1. It was originally estimated that 2020 would increase by 6.3% to 129.1GW compared with 121.4GW in 2019. However, due to the impact of the COVID-19, it is estimated to decrease to 117.1GW. The market is estimated to be 134.8GW in 2021, an increase of about 15% over 2020.
2. Most of the projects delayed by the epidemic in 2020 will resume in 2021. As China will abolish subsidies and the U.S. tax credit will expire (in 2020 and 2021 respectively), it leads to the sharp growth in project development and increase the demand in 2021.
3. According to the forecast, the new demand will reach 168.5 GW in 2022, 184 GW in 2023 and 199.8 GW in 2024. The world's photovoltaic capacity will increase from 630 GW this year to 1.4 TW at the end of 2024.





Tainergy's Regional Advantages in Vietnam

Reduction of Investment Tax Credit (ITC) in the U.S.

2019	30%
2020	26%
2021	22%
After 2022/1/1	Utility & Commercial 10% Residential 0%

U.S. Tariff on Bi-facial modules in 2020

AD & CVD	14.70%
201	0%
301	25%
All duties of China	39.70%
AD	4.39%
201	0%
All duties of Taiwan	4.39%

1. The reduction of investment tax credit (ITC) in the U.S. is expected to stimulate a rush for installation in residential and commercial markets from the half end of 2020 to 2021.
2. Export of Bi-facial modules made in Vietnam to the United States is duty-free. The rate of all duties of China's is 39.70% and Taiwan's 4.39%.
3. There is no AD, CVD, 301 duty and no 201 duty for the first 2.5GW for export of solar cells made in Vietnam to the United States.
4. Taking the advantages of made-in-Vietnam, Tainergy estimates that about 95% of the products will target to the higher priced U.S. market in 2020-2021, which leads to increase revenue and profit.

PV system BU

- Subsidiary Cheng Yang Energy was sold in 1H 2020.
- Currently owns 3.44MW PV systems
- Still focuses on development and investment of domestic PV systems
- Expanding maintenance services .

Subsidiary: TAISIC Materials Corp.

Founded：Jun. 2020

Representative：Kevin Hsieh

Main Product：SiC Substrates

Investors：Tainergy 64%

Kenmec 10%

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Semiconductor Materials

- 1st Gen. : Ge, Si
  - Microelectronics, IE
- 2nd Gen. : GaAs, InP
  - Communication, Illumination
- 3rd Gen. : SiC, GaN
  - High Voltage Power、HF Communication

Physical Properties of SiC

Properties		Si	SiC	
Bandgap	eV	1.12	3.2	~3x
Electron Mobility	cm^2/Vs	1500	650	
Electron Field for Breakdown	MV/cm	0.3	3.5	~10x
Saturated Drift Velocity	x 10^7 cm/s	1.0	2.0	~2x
Thermal Conductivity	W/cm/K	1.5	4.5	~3x

Advantages of SiC Devices

- High Power Applications
- Ultra High Working Voltage
- Ultra High Frequencies
- More Stable at High Temp.
- Excellent Radiation Resistance
- Smaller Module Size

SiC Device Applications

SiC Substrates

N-type

LED

LED

Power Devices
(SBD、MOSFET…)

UPS

xEV

PV

Wind Power

HSR

SI

MW Devices
(HEMT)

5G small cells

Satellite

RADAR

Applications of High Power SiC & GaN Modules

Low-Voltage

PFC/Power supply

Audio Amplifer

Medium-Voltage

PV Inverter

Motor Control

EV/HEV

UPS

High-Voltage

Ship&Vessels

Smart Power Grid

Wind Mills

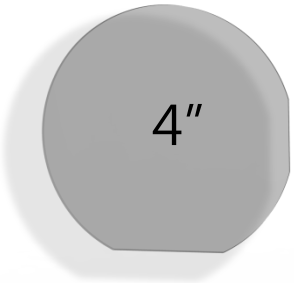
Rail Transport

<200V | 600V | 900V | 1.2kV | 1.7kV | 3.3kV | 6.5kV+

SiC diodes

GaN-on-Si Transistors | Battle fields | SiC Transistors

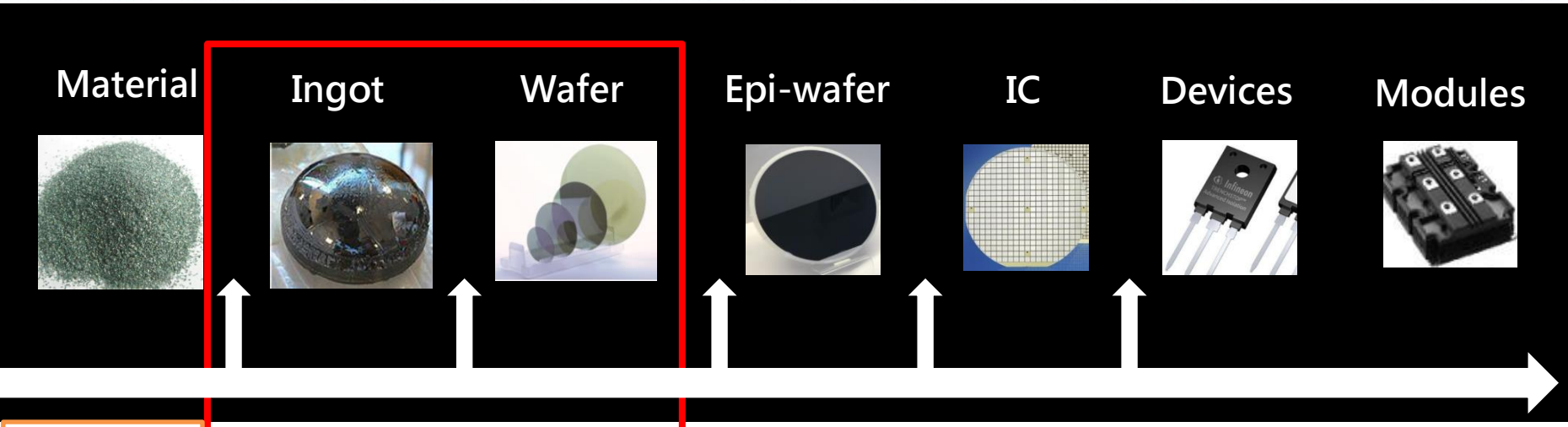
Reference Price of SiC Substrates



- N-type: USD 500/pcs
- SI: USD 1,800/pcs

- N-type: USD 1,500/pcs
- SI: USD 4,000/pcs

Industrial Chain of SiC



In House
ACME、
USIO

Crystal Growth
Finishing

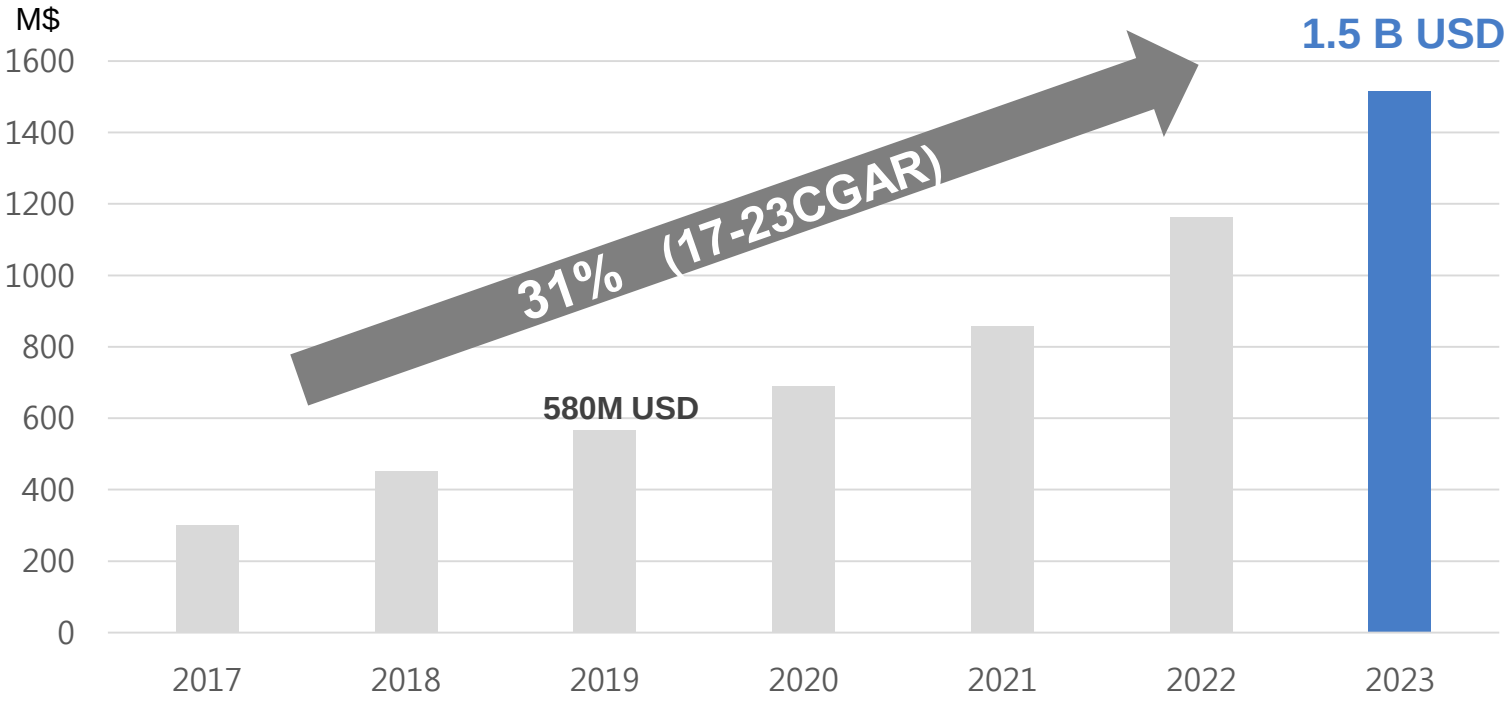
4934Tainergy (Taisic)

Epitaxy
Foundry
Package

Cree、II-VI、GTAT、Rohm
SK Siltron(DuPont)、NSC
TenkeBlue、SICC、Semicore、
6488 GlobalWafers、3583 Scientech、
8028 PSI

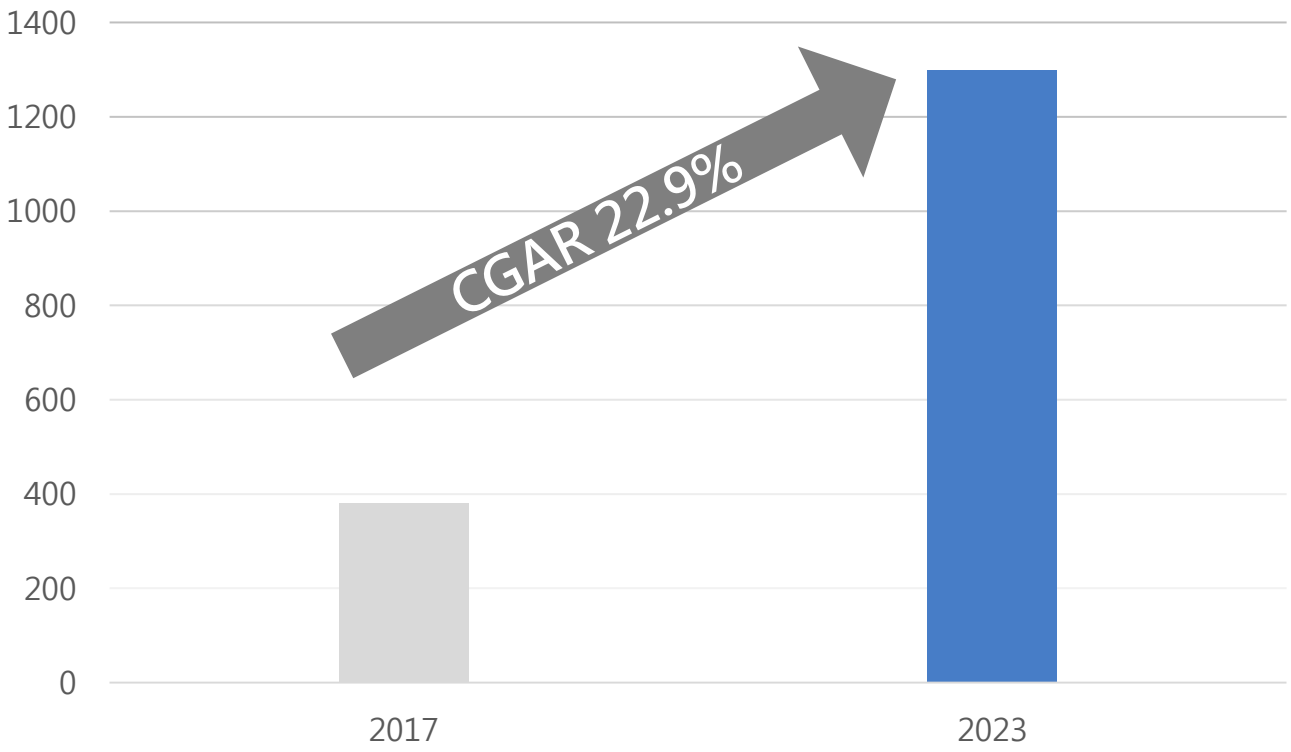
Wolfspeed、Rohm、Infineon、ON Semi、
Qorvo、Mitsubishi、STMicroelectronics、
X-Fab 、EpiWorld
3105 WIN、2455 VPEC
3016 Episil-Precision、3707 EPISIL

Market Forecast of SiC Power Devices



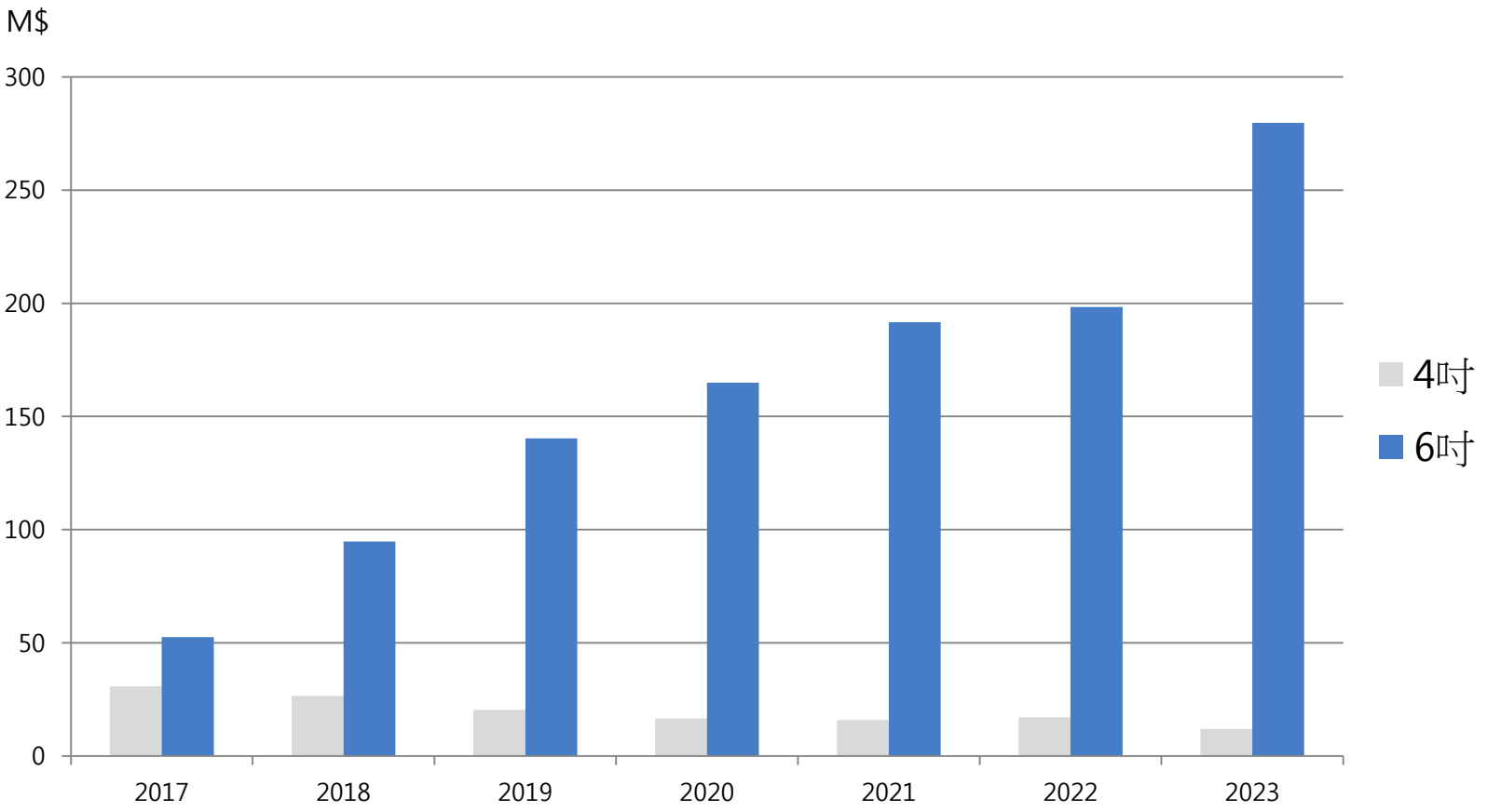
source：Yole Développement

Market Forecast of SiC HF Devices



source : Yole Développement

Market Value of n-SiC Substrate



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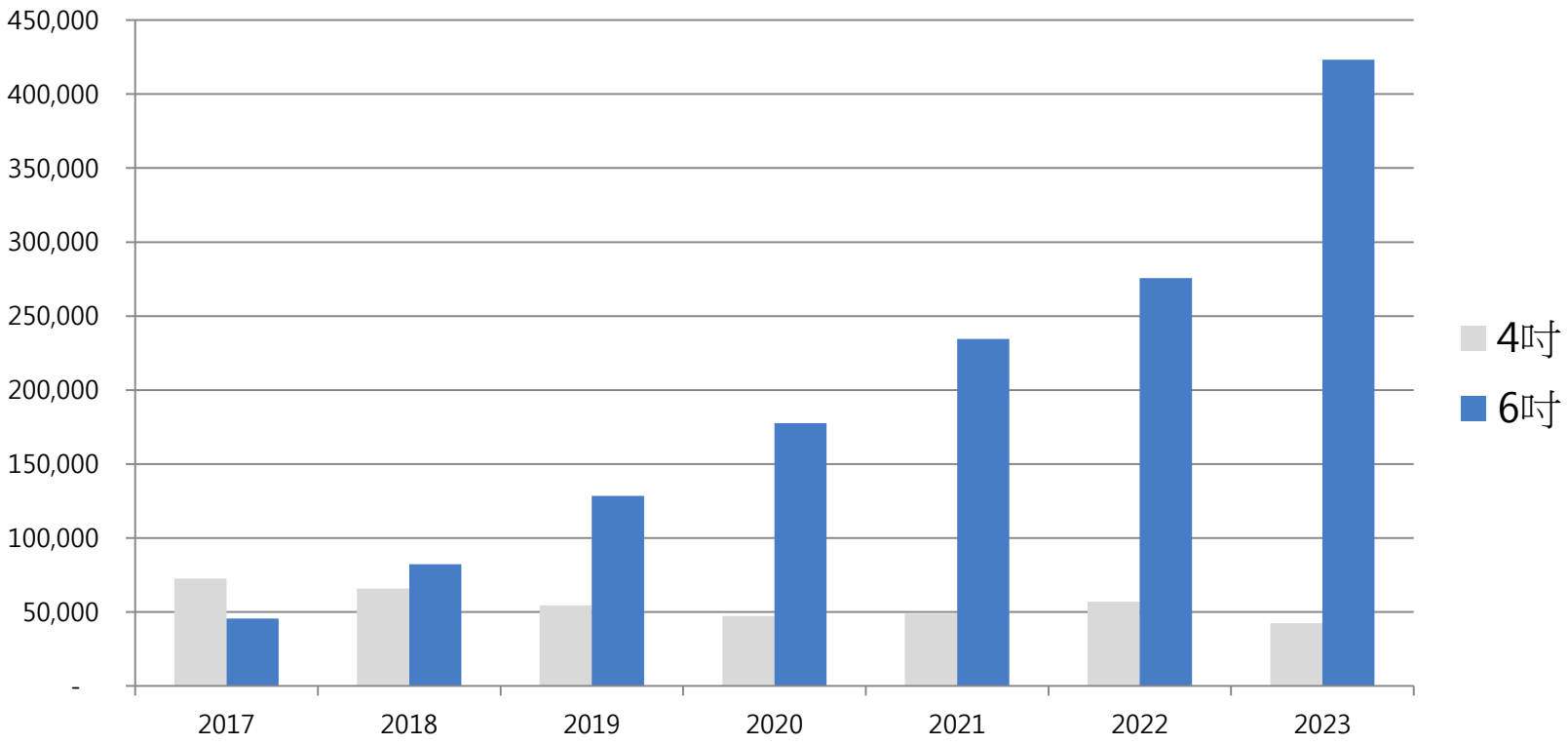
Market Demand of n-SiC Substrate



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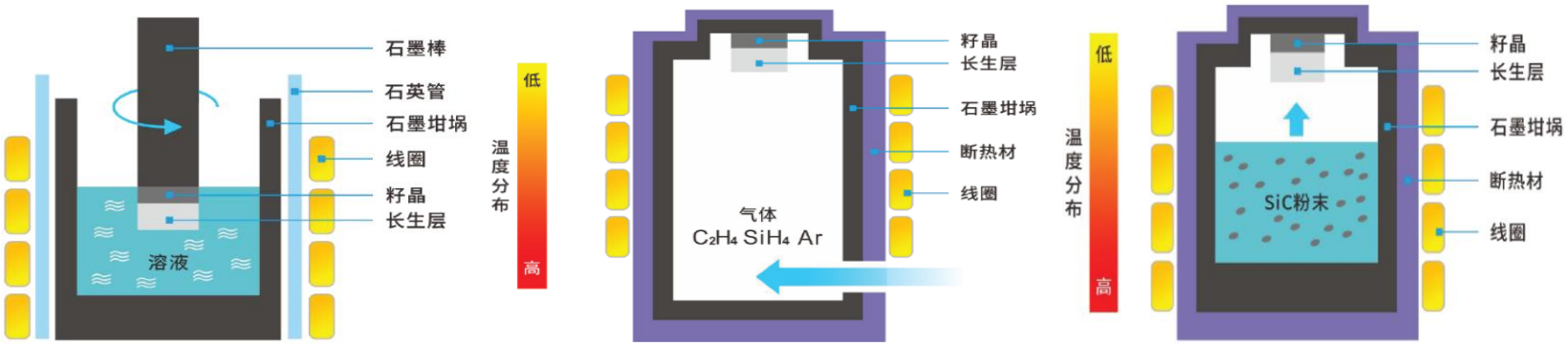
Crystal Growth of SiC

LPE HTCVD PVT



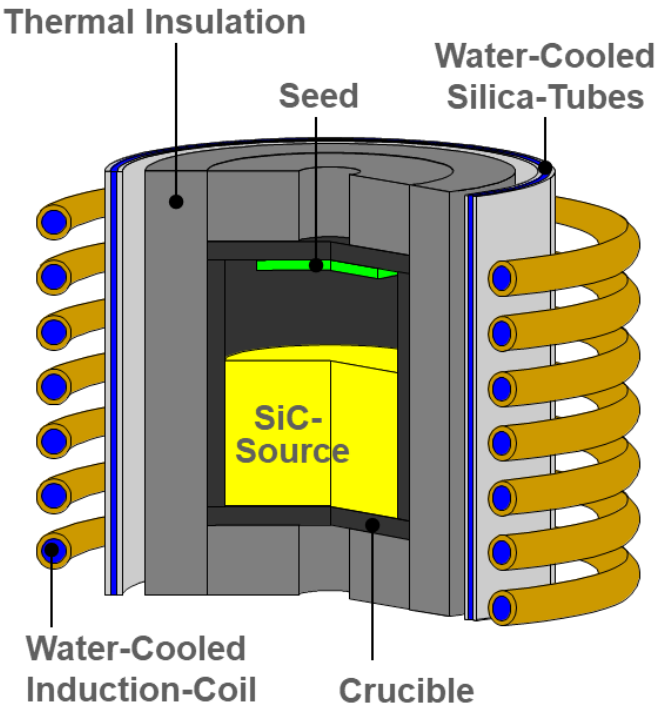
LPE: Liquid Phase Epitaxial

HTCVD: High Temperature Chemical Vapor Deposition

PVT: Physical Vapor Transport

Schematic of SiC PVT Crystal Growth

1. it is impossible to in-situ observe the crystal growth in the black box of graphite crucible. The SiC crystal seeds, graphite crucible and high-purity SiC raw materials can not be used again. It has to destroy the crucible to confirm the success or failure of the SiC crystal growth.
2. The crystal growth rate is slow –only 20mm thick after 7 days' growth.
3. As SiC has more than 200 polytypes, needs accurate thermal field, flow field, electrical field control as well as accumulated experiences to grow large size, defect free and uniform 4H single crystal.



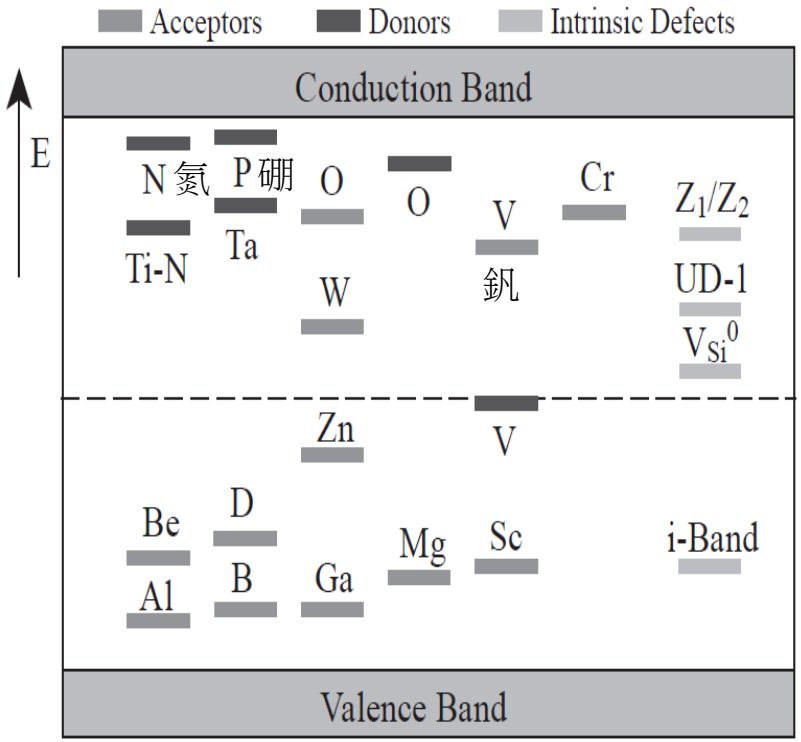
Summary of SI-SiC Crystal Growth

High purity Crystal Growth

- The resistance of SI-SiC substrate is required to be more than 1e6 Ω· cm. There are two technologies to meet requirements:

1. By doping vanadium to modify the electrical properties of the substrate. It will cause crystal defects and results in reduced yield of components, which will increase the complexity of crystal manufacturing and increase the cost.
2. By controlling the purity and defects in SiC crystal growth so as to increase the resistivity. In addition to high purity raw materials and low impurity in graphite crucibles, it is also necessary to overcome the nitrogen content in the environment. (the conductivity will be increased when the nitrogen content in SiC crystal is high).

Vanadium Doping



Features of SiC Crystal Growth

Long Time

Si：3~4 days
SiC：7 days

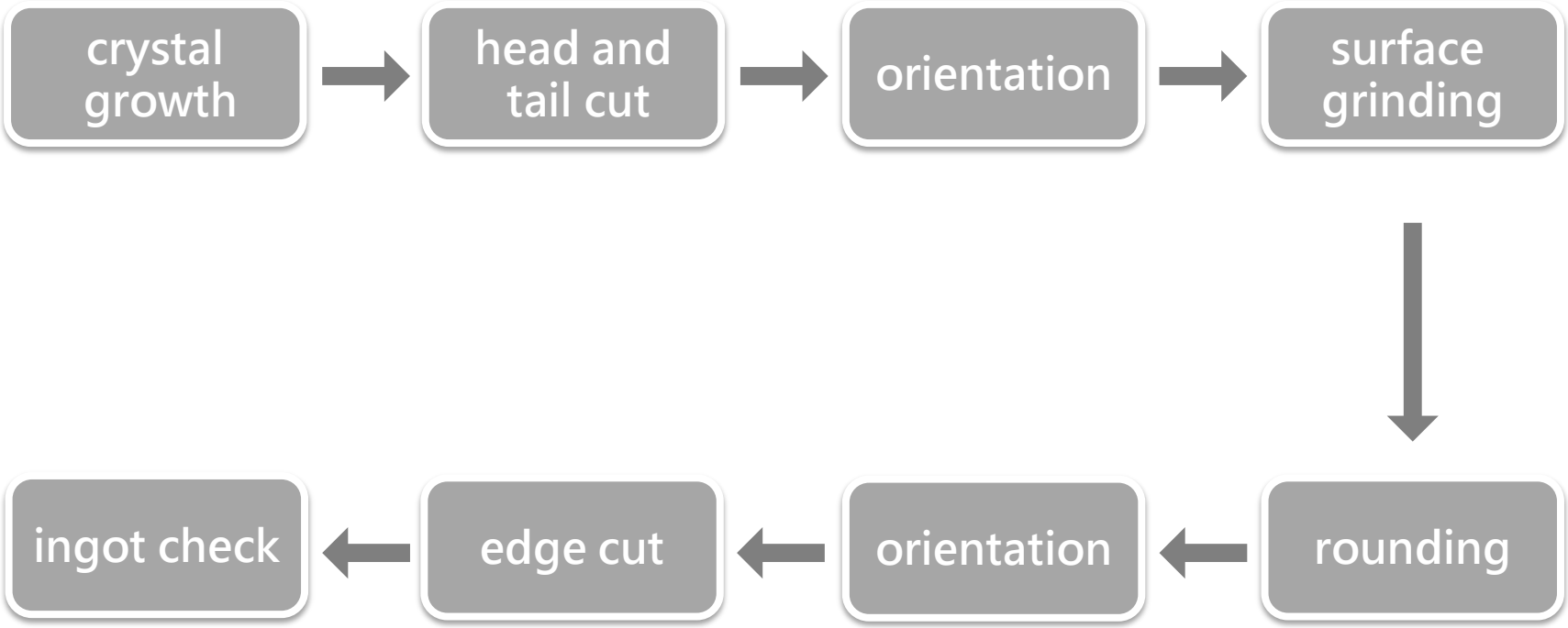
Short Length

Si：200 cm
SiC：2 cm

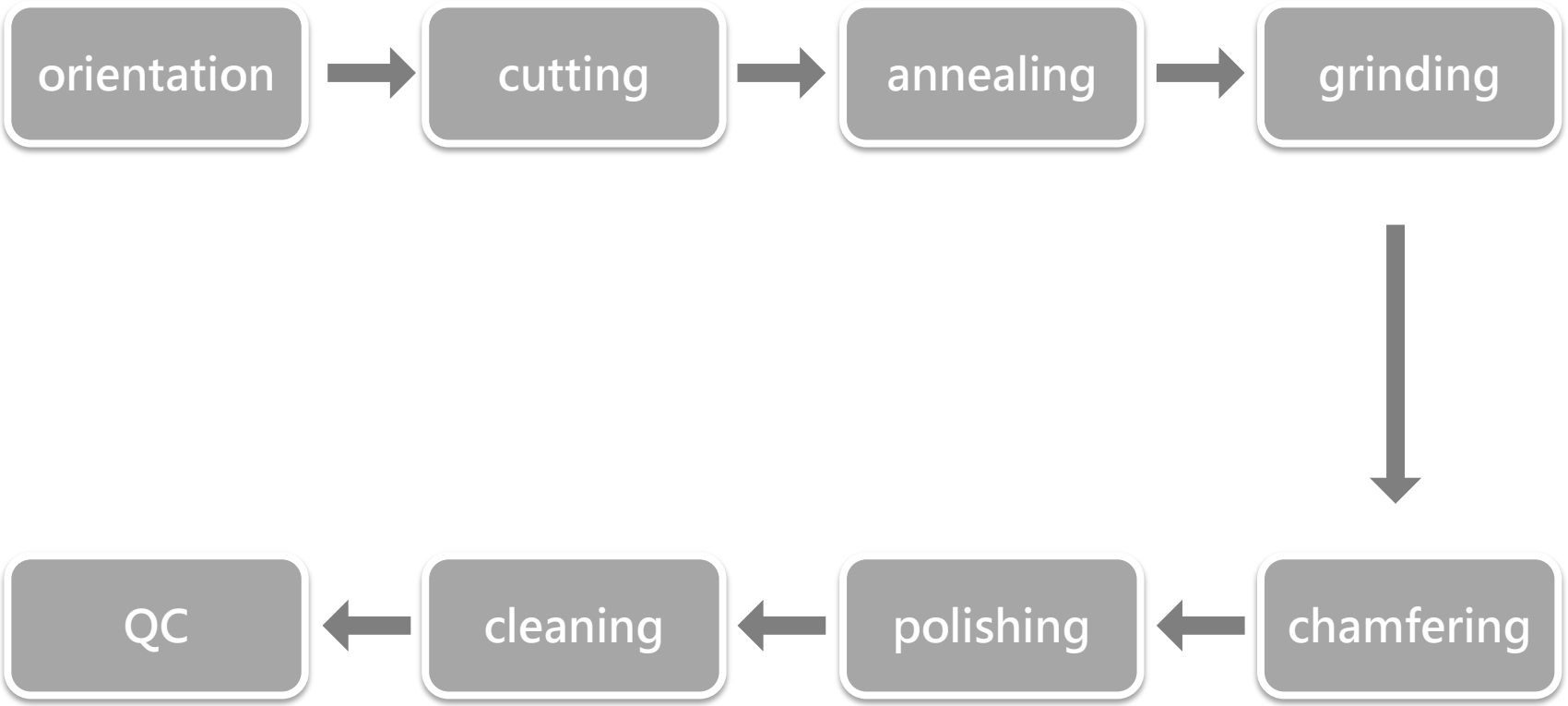
High Purity

Raw materials and Seed

Process Flow of SiC Ingot



Process Flow of SiC Wafer



The 3rd semiconductor EQs developed by Kenmec

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Conclusions

- There will be explosively market growth in SiC applied in both power devices and HF communications in the near future.
- It is the prime time to invest in SiC substrate business, as the technology barriers and demand more than supply.
- Tainergy and the subsidiary TASIC have actively stepped into the field of SiC substrate manufacturing and developed our own core patents and technologies. We are now in the stage of product verification and certification, and mass production is expected to start in Q1, 2021.

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Into The New Semiconductor Era