分子束磊晶系統 (Molecular Beam Epitaxy)

規格(Specifications):

This research MBE system of III-V compounds should meet the requirements of growing high-quality 3-inch GaAs wafer.

本III-V族化合物專用研究型分子束磊晶系統, 需能滿足生長高品質3吋砷化鎵晶圓之需求.

The entire system should include the following configurations:

整套系統需包括以下組態:

1. SYSTEM FRAME系統架構

1.1 The complete system is composed of two separate and independent frames:

整個系統由兩個獨立分離的機架構成:

(1) Independent electrical cabinet frame

(2) Independent MBE system frame

1.2 The electrical cabinet frame is independent from the MBE system frame

 電氣控制櫃機架與MBE系統機架彼此獨立

1.3 The fluids distribution panels (for water, compressed air, and dry nitrogen) are incorporated on the MBE system frame, and not on the electrical cabinet frame

 流體分配面板(用于: 水、壓縮空氣與乾燥氮氣)設置於MBE系統機架上, 而非電氣控制櫃機架.

1.4 Growth Chamber Baking Temperature is 200°C +/- 20°C

 磊晶室的烘烤溫度為200°C ± 20°C.

1.5 Transfer height: max height of the transfer level cannot be higher than 1.35m

 轉移高度: 轉移操作的最大高度不得超過1.35m

2. MBE GROWTH CHAMBER分子束磊晶 成長腔體

2.1. Growth chamber geometry

磊晶室幾何形狀

(1) Vertical MBE reactor for epitaxy growth on substrate platen positioned horizontally,

 optimized growth chamber design for high layer uniformity and optimized material

consumption for substrate size of 2” or 3”.

垂直式MBE反應器設計, 用於在水平放置的基片承載台上進行外延生長,

優化的磊晶室設計, 實現較高的層均勻性, 可對2”或3”基板的材料消耗進行優化.

(2) 12 source ports symmetrically distributed on the MBE growth chamber, including 8 cell

ports with CF 63 (4,5”) mounting flange, and 4 cell ports with CF 35 (2 ¾ ”) mounting flange

MBE磊晶室需具備12個蒸鍍源埠, 並採對稱分佈設計, 包括8個備有CF 63 (4,5”) 法蘭的單元埠, 以及4個備有CF 35 (2 ¾”)法蘭的單元埠.

(3) Source ports oriented at 40° degrees to the vertical - same incident angle to the substrate for all effusion cells.

 蒸鍍源埠與垂直方向成40°度角 -- 所有擴散元素單元與基板的入射角皆相同

(4) Individual mounting flange for each of the 12-source shutter with symmetrical

arrangement

 每一個對稱分佈設計的蒸鍍源擋板, 皆有單獨的安裝法蘭.

2.2. Main cooling

 主要冷卻裝置

1. Dedicated water-cooled source ports for each effusion cells (QTY = 12)

(2) Full LN2 cryo-shroud surrounding the epitaxy volume and the effusion cell mouths for

minimizing the heat load in the growth chamber (A mixed cooling between LN2 and

water is not permitted for the main cryo-shroud)

2.3. Beam flux separators (“Cell dividers”): Each source should be enclosed between high refractory material separators for beam flux separation between effusion cells in the growth chamber.

 束流分離器(“蒸發源分隔器”): 每個蒸鍍源應封閉在高耐火材料分離器之間, 以便在磊晶室中實現有效的束流分離.

2.4. Pumping well:

 抽氣井: 高真空系統專用

1. Dedicated pumping area (Pumping well) mounted on the side of the MBE growth chamber with:

專用抽氣區(抽氣井)設置於MBE磊晶室側邊, 配備以下設備:

(a) 1 x LN2 cryo-shroud mounted in the pumping well + CF63 port on it for TSP (Titanium Sublimation Pump)

(b) 1 x dedicated side pumping port for CT8 cryopump connection (1500 l/s for N2) with its Isolation pneumatic Gate Valve. Including Primary Pump for Cryo-Pump regeneration.

(c) 1 x dedicated inline CF 150 (8”) pumping port for ion pump connection (200 l/s for N2) with its Isolation manual Gate Valve

(2) RGA should be installed on the Pumping well (200 amu, model from Hiden HALO 201 RC)

殘留氣體分析儀(RGA)需安裝於抽氣井上, 最大偵測質量數為 200 amu, 型號為 Hiden HALO 201 RC.

2.5. Growth chamber pressure measurement磊晶室壓力測量

(1) Secondary vacuum measurement system: 二次真空測量系統:

High sensitivity Bayard-Alpert ion gauge/ Measurement range 10-3 to 2x10-11 Torr

 with Ion gauge controller and cables.

高靈敏度Bayard-Alpert 離子計/測量範圍10-3至2x10-11 Torr.

配有離子計控制器和電纜.

(2) Primary vacuum measurement system: 一次真空測量系統:

Convection ion gauge/ Measurement range 103 to 10-3 Torr

對流離子計/測量範圍103至10-3 Torr

2.6. Growth chamber vacuum: Ultimate pressure should be better than 5x10-11 Torr with LN2 in cryo-panel

磊晶室真空: 使用液氮冷卻面板時, 磊晶室的最佳真空度需優於5×10⁻¹¹ Torr

2.7. Source shutters

 蒸鍍源擋板

(1) System must be equipped with 8 x Cell shutters mechanism with rocking motion and

intelligent electrical motors (12 Ports are available on the Growth Chamber)

系統必須配備8 x具有搖擺運動的元素單元擋板機構以及智慧電動馬達(磊晶室上有 12個連接埠)

1. Tantalum double blade design for Ga, In and Al Materials

適用於Ga、In和Al材質的鉭雙葉片設計

(3) Tantalum single blade for Dopant materials

鉭單葉片設計, 用於摻雜元素

2.8. Instrumentation ports, MBE growth chamber must have the following ports for instrumentation:

 儀器連接端口, MBE磊晶室必須具備以下儀器連接端口:

 (1) 2 x CF35 Ellipsometer Ports

(2) 2 x CF35 OFM ports

(3) 1 x CF35 Pyrometer port

(4) 2 x CF35 and 1 x CF100 Ports on the bottom part of the chamber for Optical Monitoring

2.9. Inspection viewports

 檢查觀察窗

(1) 1 large CF 150 (8”) inspection viewport with manual shutter for transfer and substrate

Inspection

需包括1個大型CF 150 (8”)檢查觀察窗, 配有手動擋板, 用於傳輸和基板檢查

(2) 3 small CF 35 (2 ¾ ”) inspections viewports with manual shutter for source inspection

 需包括3個小型CF 35 (2 ¾”)檢查觀察窗, 配有手動擋板, 用於蒸鍍源檢查

2.10. Beam flux gauge: Motorized beam flux gauge interfaced to the control software for automatic

flux measurement routine

 束流通量計: 具馬達驅動的束流通量計, 可與控制軟體連動,自動執行束流通量量測程序

3. MBE SOURCES分子束磊晶 蒸鍍源

3.1. Valved Arsenic cracker source (VAC 500) and Valve controller, QTY = 1

 As閥門裂解加熱單元(VAC 500)和閥門控制器, 數量 = 1

(1) The As valved cracker source is secured by the MBE control software to prevent any

misuse that could lead to the source damage or destruction.

砷閥門裂解加熱單元由MBE控制軟體保護, 以防止任何因不正確使用導致的源損壞或毀壞

1. One thermocouple for cracker heating zone

裂解爐加熱區用熱電偶1個

1. One Thermocouple for reservoir

Reservoir用熱電偶一個

(4) Water-cooled 550cc capacity titanium crucible

 水冷式550cc容量鈦坩堝

3.2. Gallium, Indium, Aluminum dual filament effusion cell (ABN 60 DF), QTY = 4

 Ga、In、Al雙加熱絲擴散元素單元(ABN 60 DF), 數量 = 4

1. PBN crucible with a nominal loading capacity of 60cc

標稱裝載容量為60cc的PBN坩堝

(2) Two TC-C Thermocouples

 兩個TC-C熱電偶

3.3. Dopant Source (for Silicon, Beryllium), Single filament Effusion cell (ABN 135 DC8), QTY = 2

 Si, Be摻雜元素用, 單加熱絲擴散元素單元(ABN 135 DC8), 數量 = 2

1. PBN crucible with a Taper of 8°

錐度8°的PBN坩堝

(2) 1 x Bottom Thermocouple

 1 x底部熱電偶

3.4. Valved Antimony cracker source (VCOR 300) and Valve controller QTY = 1

 Sb閥門裂解加熱單元(VCOR 300)和閥門控制器, 數量 = 1

(1) The Sb valved cracker source is secured by the MBE control software to prevent any

misuse that could lead to the source damage or destruction.

銻閥門裂解加熱單元由MBE控制軟體保護, 以防止任何因不正確使用所導致的源損壞或毀壞

1. Full PBN Valve and Crucible

全PBN閥門和坩堝

(3) 300 cc Capacity

300 cc容量

(4) One thermocouple for cracker heating zone

裂解爐加熱區用熱電偶1個

(5) One Thermocouple for reservoir

Reservoir用熱電偶一個

(6) Water-cooled

水冷式

4. MBE MANIPULATOR分子束磊晶 基板操作器

4.1. Manipulator: Model PSCT D100 (4”) for 3” Substrate

 基板操作器: 型號 PSCT D100 (4”), 適用於3”基板

1. Highly stable and uniform temperature

高度穩定, 溫度具均勻一致性

1. Heater optimized for a max continuous temperature of at least 800°C

加熱器經過最佳化, 最高持續溫度至少為 800°C

(3) The heater is made of one flat tantalum filament

 加熱器由一根扁平的鉭加熱絲所製成

4.2. Motorized main shutter

 電動主擋板

(1) Motorized main shutter for simplified and quicker calibrations steps.

 電動主擋板可簡化並加速校準步驟.

5. WAFER HANDLING AND TRANSFER SYSTEM晶圓處理與傳送系統

5.1. Buffer chamber and Loading/Unloading chamber

 緩衝室及基板裝載/卸載室

1. The buffer chamber is located above the loading/unloading chamber

緩衝室位於基板裝載/卸載室上方

5.2. Platen cassettes

 基板承載匣

1. One fixed cassette with 2 platen positions located in the buffer chamber

緩衝室內具有一個固定式卡式匣, 此匣具有2個可置放基板承載台的位置.

1. One mobile cassette with 6 platen positions in the loading chamber

裝載室內具有一個移動式卡式匣, 此匣具有6個可置放基板承載台的位置.

5.3. Platen lift

 基板承載台升降裝置

(1) Motor driven cassette lift with remote control on touch pad (no manual lift) for move of mobile cassette between loading/unloading chamber to buffer chamber

5.4. Visual inspection viewports for manual transfer operation

 系統需具有目視檢查觀測窗設計, 以便觀察手動傳輸操作

5.5. Buffer chamber - degassing station:

 緩衝室 - 脫氣站:

1. 800°C degassing station

800°C脫氣站

1. Pumping Configuration: Ion Pump with TSP (4 filaments)

泵組態: 具備TSP的離子泵(4根加熱絲)

(3) Secondary vacuum measurement system: 二次真空測量系統：

High sensitivity Bayard-Alpert ion gauge / Measurement range 10-3 to 2x10-11 Torr

高靈敏度Bayard-Alpert離子計/測量範圍10-3至2x10-11 Torr

5.6. Buffer chamber vacuum: Ultimate pressure should be better than 5x10-10 Torr

 緩衝室真空: 緩衝室的最佳真空度需優於5x10-10 Torr

5.7. Loading Chamber

 基板裝載室

1. Turbomolecular pump (minimum speed 65 l/s / N2)

渦輪分子幫浦(最低轉速65公升/秒/N2)

(2) Secondary vacuum measurement system:

High sensitivity ion gauge / Measurement range 102 to 10-9 Torr. Local pressure display.

二次真空測量系統:

高靈敏度離子計/測量範圍102至10-9 Torr

(3) Equipped with IR Lamps

配備紅外線燈

6. MBE CONTROL COMPUTER AND SOFTWARE分子束磊晶 控制電腦和軟體

6.1 Specifications of control computer which is integrated in electrical cabinet:

(minimum spec., should be equivalent or better)

電氣控制機櫃整合型控制電腦規格: (最低規格)

(1) INTEL I5 12500TE 1.90 GHz 18 MB LGA1700

(2) Solid-State Drive - 500 Go

(3) 8GB DDR4 DIMM-3200 1GbX8 SAM

(4) Windows 11 IoT Enterprise 2024 LTSC

(5) 1 x RS485 Port

(6) 4 x RS232 Port

6.2 Monitor 24” should be located on the computer table provided with the system (not integrated in electrical cabinet)

 24吋顯示器, 需置於系統提供的電腦桌上(非整合於電氣控制櫃内)

6.2 The MBE control software should be developed in house and includes free of charge updates within the warranty period.

 MBE 控制軟體需為原廠自行開發, 並於保固期內提供免費更新

7. Final Acceptance Test:測試

Based on the following document:

根據下述文件

“CUSTOMER SITE TESTING for COMPACT 21 DZ III-V RESEARCH SYSTEM, Ref: P/N 608 87 L 42”,

Perform and complete the tests described in the document during the installation process.

 在安裝過程中執行並完成文件中所述測試.

8. Warranty保固期:

12 months after final acceptance

自驗收合格日起算1年

9. Performance Period:履約期限

Within 660 days after the winning bidding day to complete installation and final acceptance

決標日起660日曆天内交貨, 完成安裝及測試