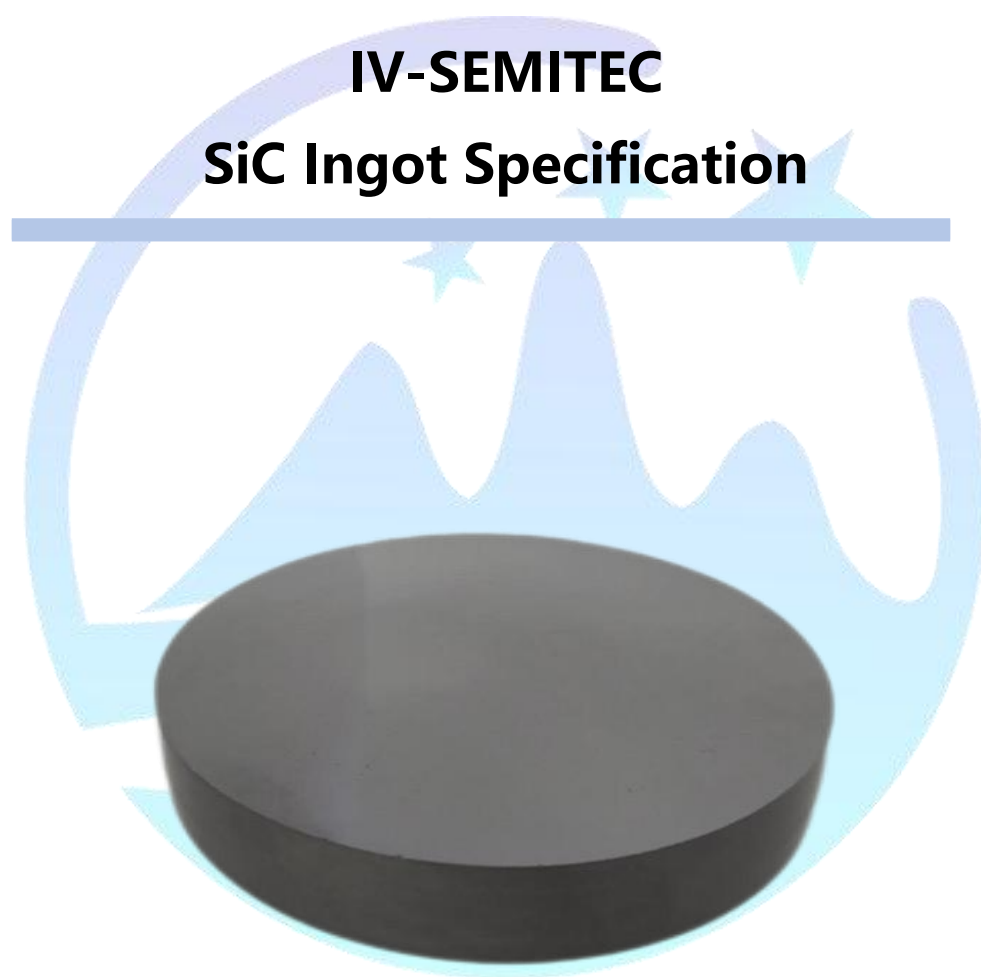


# 浙江材孜科技

## 碳化硅晶锭规格

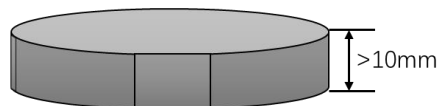


## 4 英寸导电型 4H-SiC 晶体 / 4-inch conductive 4H-SiC ingot

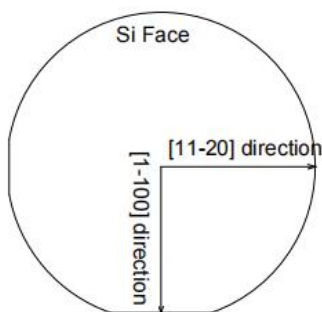
| 产品分级 / Product Grade                        | P (Product grade)                               | D (Dummy grade)                  |
|---------------------------------------------|-------------------------------------------------|----------------------------------|
| 直径 / Diameter (mm)                          | 100.2 ± 0.2                                     |                                  |
| 厚度 / Thickness (mm)                         | ≥10                                             |                                  |
| 导电类型/掺杂元素<br>/ Conductivity Type/Dopant     | n-type/ Nitrogen                                |                                  |
| 电阻率范围 / Resistivity range (Ω·cm)            | 0.015–0.028                                     |                                  |
| 微管密度/ Micropipe density (cm <sup>-2</sup> ) | ≤ 0.5                                           | ≤ 5                              |
| 表面取向/ Surface orientation                   | {0001}± 0.2° , 4° tilt toward [11-20] ±0.5°     |                                  |
| 主定位边取向<br>/ Primary Flat Orientation        | ⊥[1-100] ± 2.0°                                 | ⊥[1-100] ± 5.0°                  |
| 主定位边长度<br>/ Primary Flat Length (mm)        | 32.5 ± 2.0                                      |                                  |
| 次定位边取向<br>/ Secondary flat orientation      | Silicon face up: 90° CW. from Prime flat ± 5.0° |                                  |
| 次定位边长度<br>/ Secondary flat length (mm)      | 18.0 ± 2.0                                      |                                  |
| 边缘裂纹 (强光灯观察) / Edge cracks                  | 0                                               | 0                                |
| 六方空洞 (强光灯观察) / Hex plates                   | 0                                               | ≤ 100μm, Qty ≤ 10 ea.            |
| 多型区 (强光灯观察) / Polytype areas                | 0                                               | Cumulative area ≤ 5%             |
| 碳包裹物 (强光灯观察)<br>/ Carbon inclusions         | Cumulative area ≤ 0.05%                         | Cumulative area ≤5%              |
| 崩边/缺口 (日光灯观察) / Edge chips                  | ≤3 ea.,<br>≤1mm width and depth                 | ≤5 ea.,<br>≤2 mm width and depth |
| 包装 / Packaging                              | 单晶锭 /Single ingot                               |                                  |

## 4 英寸晶锭的厚度、定位边取向和几何尺寸示意图

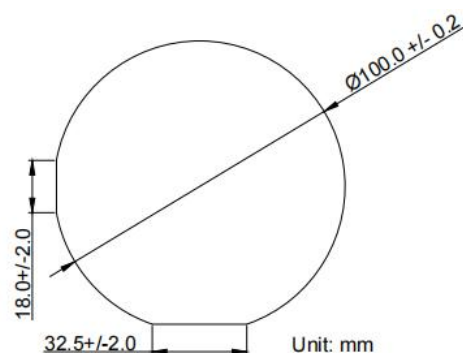
3D 示意图



定位边取向



几何尺寸

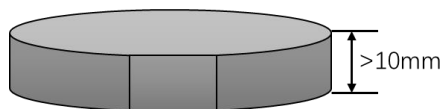


## 6 英寸导电型 4H-SiC 晶体 / 6-inch conductive 4H-SiC ingot

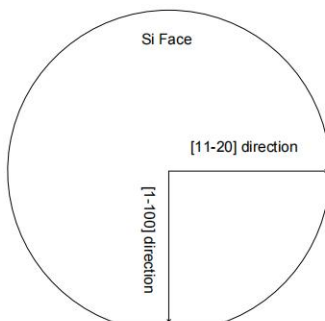
| 产品分级 / Product Grade                           | P 级 (Product grade)                            |      |       | D 级 (Dummy grade)             |
|------------------------------------------------|------------------------------------------------|------|-------|-------------------------------|
| 直径/ Diameter (mm)                              | 150.2 ± 0.2                                    |      |       |                               |
| 厚度 / Thickness (mm)                            | ≥10                                            |      |       |                               |
| 导电类型/掺杂元素<br>/ Conductivity Type/Dopant        | n-type/ Nitrogen                               |      |       |                               |
| 电阻率范围 / Resistivity range (Ω•cm)               | 0.015–0.028                                    |      |       | 0.015–0.028 (75% area)        |
| 微管密度 / Micropipe density ( cm <sup>-2</sup> )  | ≤ 0.5                                          |      |       | ≤ 5                           |
| 位错密度 / Dislocation density (cm <sup>-2</sup> ) | TED                                            | TSD  | BPD   | /                             |
|                                                | ≤6000                                          | ≤300 | ≤1200 |                               |
| 表面取向 / Surface orientation                     | {0001}± 0.2° ,    4° tilt toward [11-20] ±0.5° |      |       |                               |
| 主参考边取向<br>/ Primary Flat Orientation           | ⊥[1-100] ± 2.0°                                |      |       | ⊥[1-100] ± 5.0°               |
| 主参考边长度<br>/ Primary Flat Length (mm)           | 47.5 ± 2.0                                     |      |       |                               |
| 边缘裂纹 (强光灯观察) / Edge cracks                     | 0                                              |      |       | 0                             |
| 六方空洞 (强光灯观察) / Hex plates                      | 0                                              |      |       | ≤ 100μm, Qty ≤ 10 ea.         |
| 多型区 (强光灯观察) / Polytype areas                   | 0                                              |      |       | Cumulative area ≤ 5%          |
| 碳包裹物 (强光灯观察)<br>/ Carbon inclusions            | Cumulative area ≤ 0.05%                        |      |       | Cumulative area ≤5%           |
| 崩边/缺口 (日光灯观察) / Edge chips                     | ≤3 ea., ≤1mm width and depth                   |      |       | ≤5 ea., ≤2 mm width and depth |
| 包装 / Packaging                                 | 单晶锭 / single ingot                             |      |       |                               |

## 6 英寸晶锭的厚度、定位边取向和几何尺寸示意图

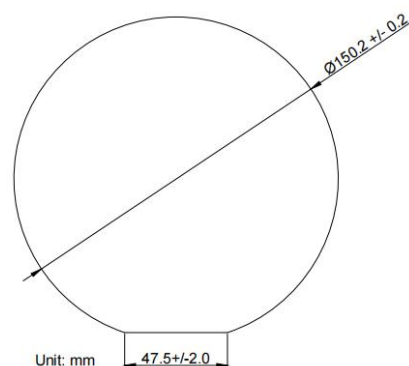
3D 示意图



定位边取向



几何尺寸

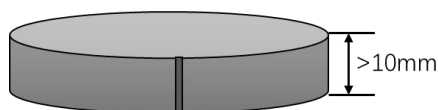


## 8 英寸导电型 4H-SiC 晶体 / 8-inch conductive 4H-SiC ingot

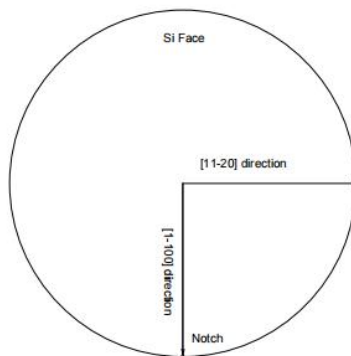
| 产品分级 / Product grade                           | P 级 (Product grade)                         |      |       | D 级 (Dummy grade)           |
|------------------------------------------------|---------------------------------------------|------|-------|-----------------------------|
| 直径 / Diameter (mm)                             | 200.2 ± 0.2                                 |      |       |                             |
| 厚度 / Thickness (mm)                            | ≥10                                         |      |       |                             |
| 导电类型/掺杂元素<br>/ Conductivity type/Dopant        | n-type/ Nitrogen                            |      |       |                             |
| 电阻率范围 / Resistivity range (Ω•cm)               | 0.015–0.028                                 |      |       | 0.015–0.028 (75% area)      |
| 微管密度 / Micropipe density ( cm <sup>-2</sup> )  | ≤ 0.5                                       |      |       | ≤ 5                         |
| 位错密度 / Dislocation density (cm <sup>-2</sup> ) | TED                                         | TSD  | BPD   | /                           |
|                                                | ≤7000                                       | ≤500 | ≤2000 |                             |
| 表面取向 / Surface orientation                     | {0001}± 0.2° , 4° tilt toward [11-20] ±0.5° |      |       |                             |
| Notch 位置取向 / Notch orientation                 | [1-100] ± 1.0°                              |      |       |                             |
| 边缘裂纹 (强光灯观察) / Edge cracks                     | 0                                           |      |       | 0                           |
| 六方空洞 (强光灯观察) / Hex plates                      | 0                                           |      |       | ≤ 100μm, Qty ≤ 10 ea.       |
| 多型区 (强光灯观察) / Polytype areas                   | 0                                           |      |       | Cumulative area ≤ 5%        |
| 碳包裹物 (强光灯观察)<br>/ Carbon inclusions            | Cumulative area ≤ 0.05%                     |      |       | Cumulative area ≤ 3%        |
| 崩边/缺口 (日光灯观察) / Edge chips                     | ≤3ea., ≤1mm width and depth                 |      |       | ≤5ea.,≤2 mm width and depth |
| 包装 / Packaging                                 | 单晶锭 / single ingot                          |      |       |                             |

## 8 英寸晶锭的厚度、Notch 取向和几何尺寸示意图

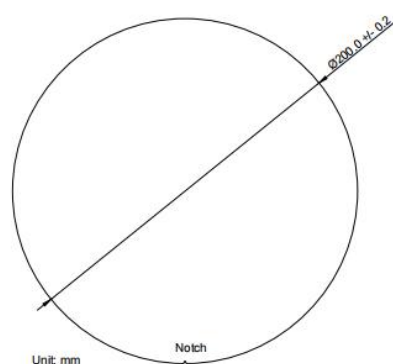
3D 示意图



定位边取向

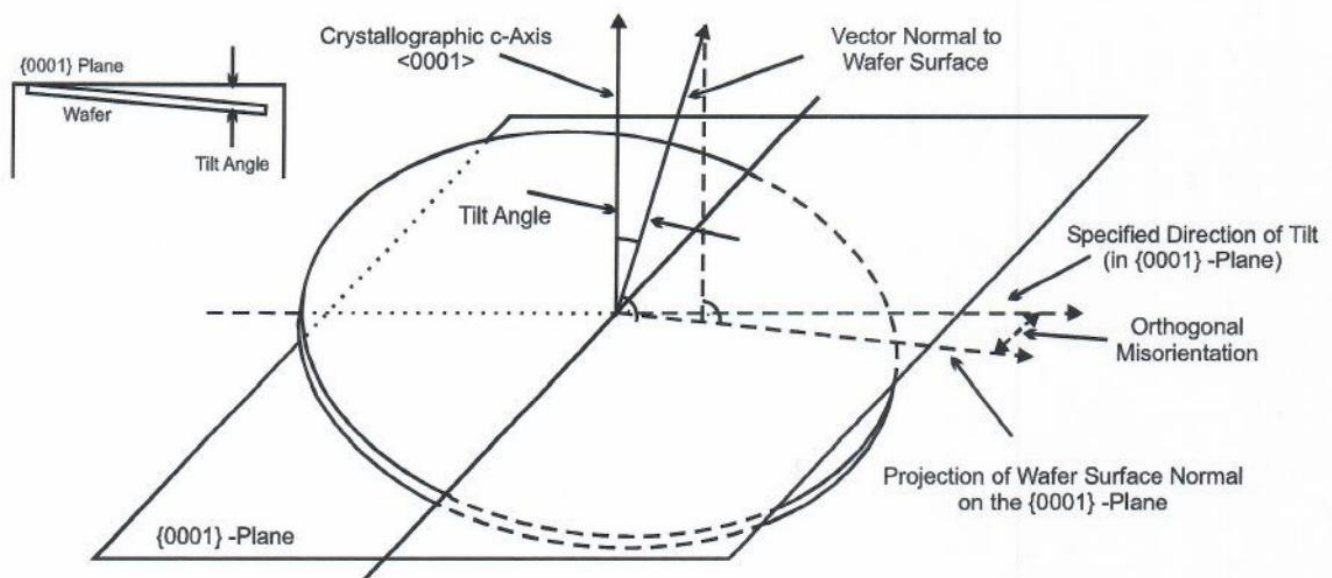


几何尺寸



## 附录 1 晶锭表面的正交取向偏离示意图

## 正交取向偏离 orthogonal misorientation



## 附录 2 晶锭的检测方法

| 一、直接检测项目                             | 检测方法     | 测试参考标准          |
|--------------------------------------|----------|-----------------|
| 直径 / Diameter                        | 千分尺      | GB/T 14140      |
| 厚度 / Thickness                       | 测厚仪      | 中心和四周 5 点       |
| 表面取向 / Wafer orientation             | X-ray 衍射 | SJ/T 11500-2015 |
| 边缘裂纹 (强光灯观察) / Cracks                | 强光灯-目检   | SJ/T 11504-2015 |
| 崩边/缺口 (日光灯观察) / Edge chips           | 日光灯-目检   | SJ/T 11504-2015 |
| 表面沾污 (强光灯观察) / Surface contamination | 强光灯-目检   | SJ/T 11504-2015 |

| 二、头尾片检测项目 (注 1)                  | 检测方法        | 测试参考标准          |
|----------------------------------|-------------|-----------------|
| 电阻率范围 / Resistivity range        | 涡电流法        | GB/T 6616-2023  |
| 微管密度 / Micropipe density         | 偏振光双折射法     | GB/T 31351-2014 |
| 位错 / Dislocation                 | KOH 腐蚀后机器识别 | GB/T 41765-2022 |
| 裂纹 (强光灯观察) / Cracks              | 强光灯-目检      | SJ/T 11504-2015 |
| 六方空洞 (强光灯观察) / Hex plates        | 强光灯-目检      | SJ/T 11504-2015 |
| 多型区 (强光灯观察) / Polytype areas     | 日光灯-目检      | SJ/T 11504-2015 |
| 碳包裹物 (强光灯观察) / Carbon inclusions | 强光灯-目检      | SJ/T 11504-2015 |

注 1：头片的截取从籽晶往晶体生长方向 3 mm 的位置；

尾片的截取从最远离籽晶端，能够截取到晶锭对应直径的位置；

分别对头片和尾片进行研磨，获得<2 nm 粗糙度的表面，进行上述检测项目。