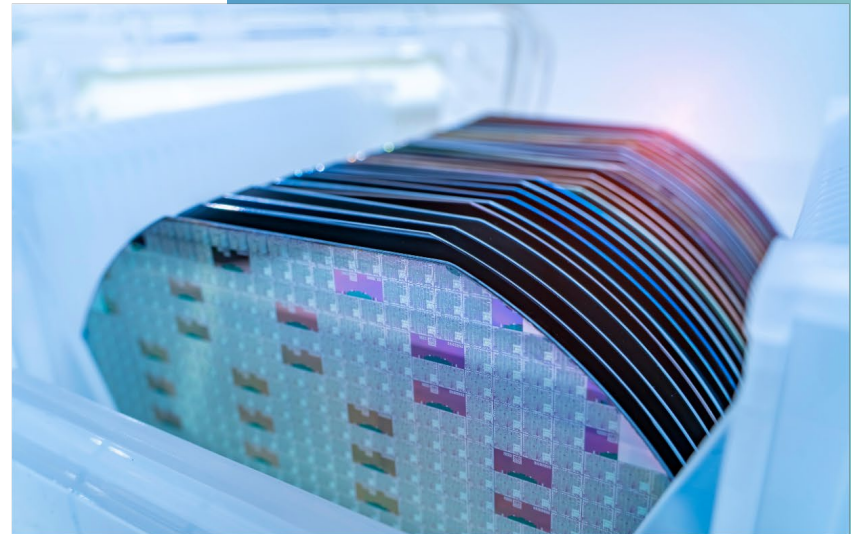
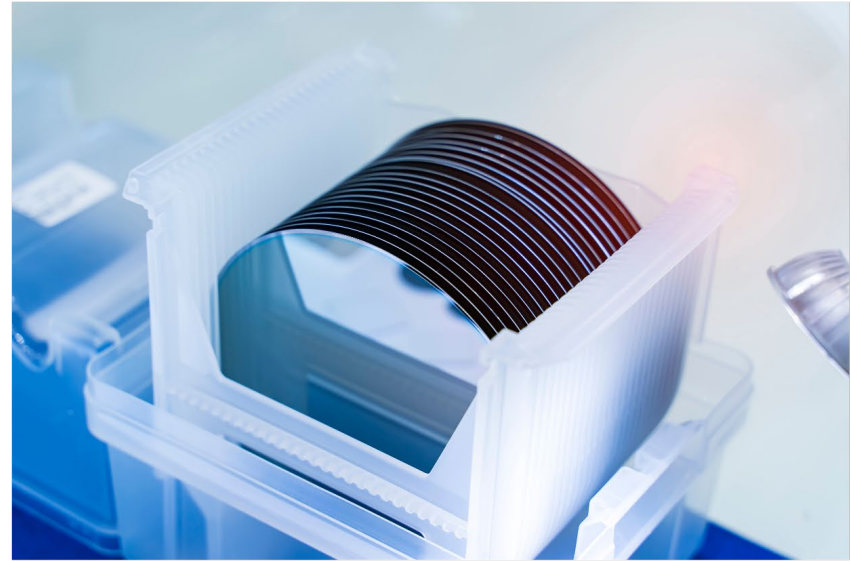




eSiC[™] Solutions Introduction

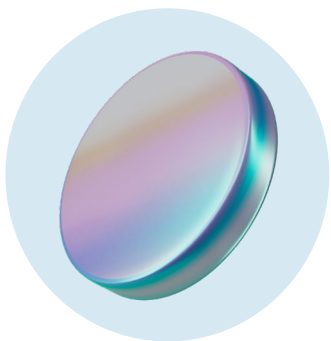
Securing the Future of Silicon Carbide

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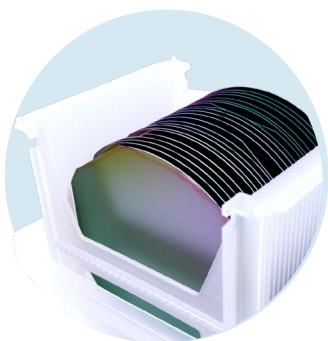
SILICON CARBIDE PRODUCTION & CHALLENGES

Navigating Complexity with eSiC Solutions



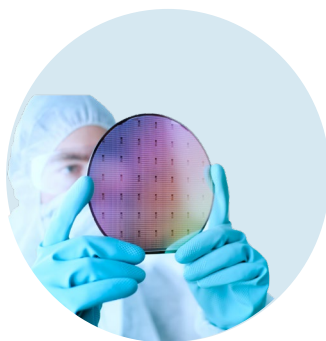
Boule Storage and Shipping

GOAL:
Ensure the boule remains free of contaminants and damage during storage and transport.



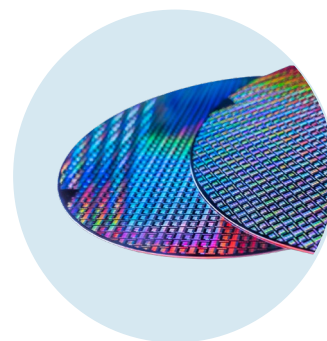
Wafering and Raw Wafer Shipping

GOAL:
Minimize potential damage and contamination during slicing and initial handling.



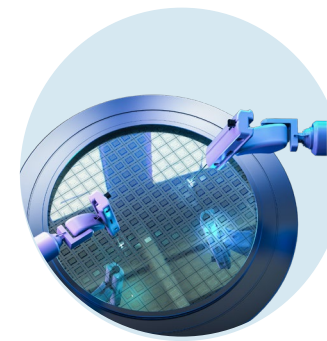
Epitaxial Growth and Device Fabrication

GOAL:
Ensure the highest standards of cleanliness and precision handling during complex fabrication processes.



Shipping of Processed Wafers

GOAL:
Secure transport of delicate and valuable processed wafers without compromising their integrity.



Dicing and Packaging

GOAL:
Handle the final and most delicate stages of the semiconductor manufacturing process.

SILICON CARBIDE CHALLENGES

Wafer Fragility

Description:

- Silicon Carbide wafers are extremely brittle and prone to cracking or breaking under stress.

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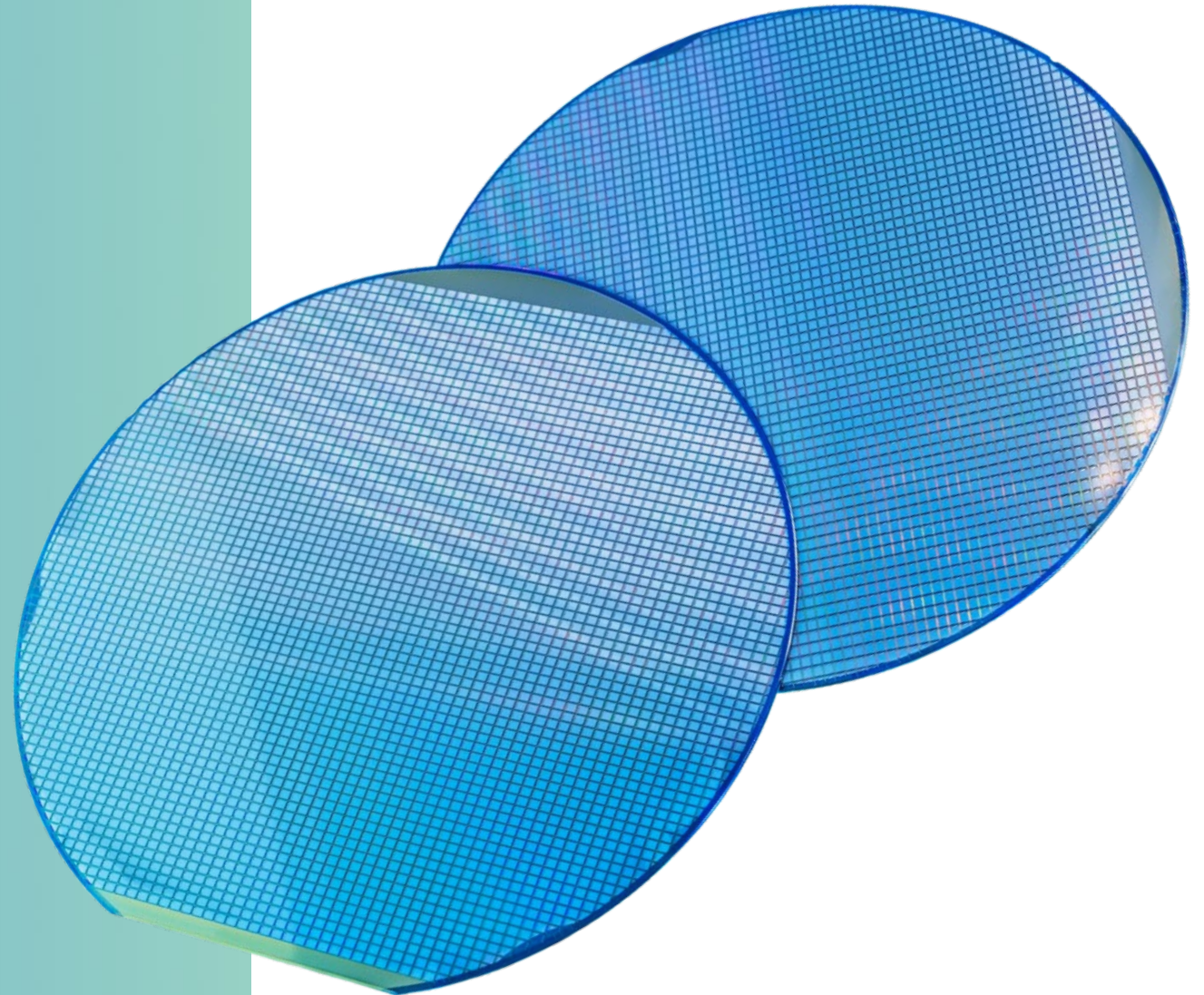
- Typical SiC wafers can fracture from stresses as low as 30 MPa, whereas silicon wafers can withstand up to 90 MPa.

ePAK Solution:

- Tailored Packaging: ePAK designs include cushioning and precise compartmentalization to mitigate stress during transport.

Product Example:

- ePRO Raw Wafer Shipping Boxes that provide custom dual row isolated cushion to accommodate specific wafer dimensions and minimize movement.



SILICON CARBIDE CHALLENGES

Sharp Edges During Production

Description:

- The slicing and dicing processes create sharp edges that can lead to particle generation when wafers rub against containers or each other.

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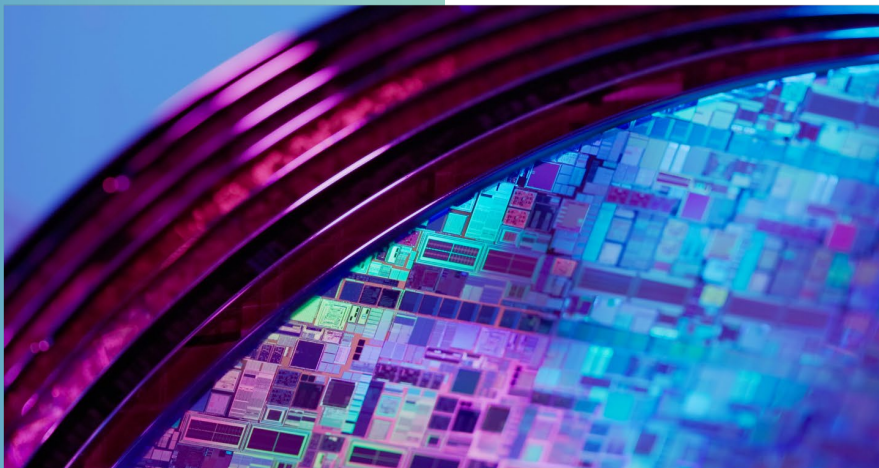
- Particle contamination can increase by up to 200% with standard containers during transportation due to friction.

ePAK Solution:

- Low Slough Materials: Containers made from materials that reduce particle shedding and resist abrasion.

Product Example:

- Engineered polycarbonate process cassettes with anti-static and low-abrasion properties to minimize particle generation.



SILICON CARBIDE CHALLENGES

High Sensitivity to Contamination

Description:

- SiC wafers are used in high-power and high-frequency applications, making them highly sensitive to contaminants which can degrade device performance.

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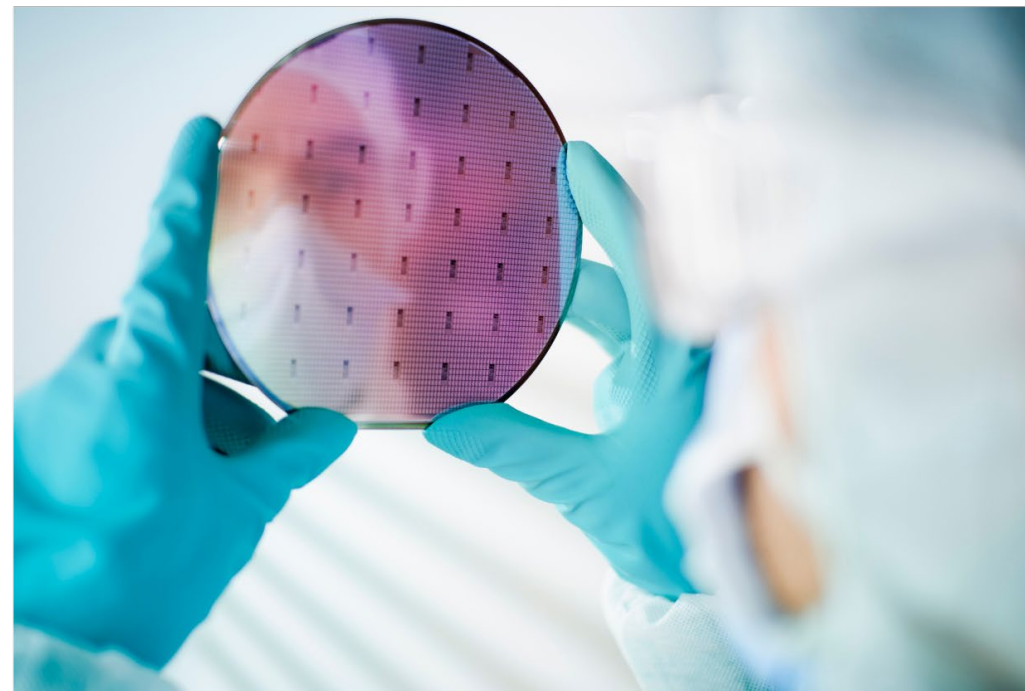
- Even particle sizes as small as 0.2 microns can impact the yield rates of SiC devices significantly.

ePAK Solution:

- Sealed Environments: ePAK offers solutions like SMIF Style ePOD Pro which provide hermetically sealed environments to prevent contamination.

Product Example:

- SMIF Style ePOD Pro for use in automated handling systems, ensuring a contaminant-free environment throughout the processing steps.





SILICON CARBIDE SOLUTIONS

Boule Growth, Storage, and Shipping

Process Overview:

- Growing a SiC boule using the Physical Vapor Transport method.
- Cooling and preparing the boule for storage and shipping.

ePAK Products:

- Wafer Jar: Specifically designed for storing and protecting large boules.
- eLX Jar: Offers enhanced protection for sensitive materials, ensuring the boule is maintained in a contaminant-free environment during transit.

Benefits:

- Both the Wafer Jar and eLX Jar provide robust physical protection and contamination prevention, essential for maintaining the integrity of the boule during subsequent processing stages.

SILICON CARBIDE SOLUTIONS

Wafering and Raw Wafer Shipping

Process Overview:

- Cleaning and preparing wafers for initial transport.
- Shipping to fab for processing.

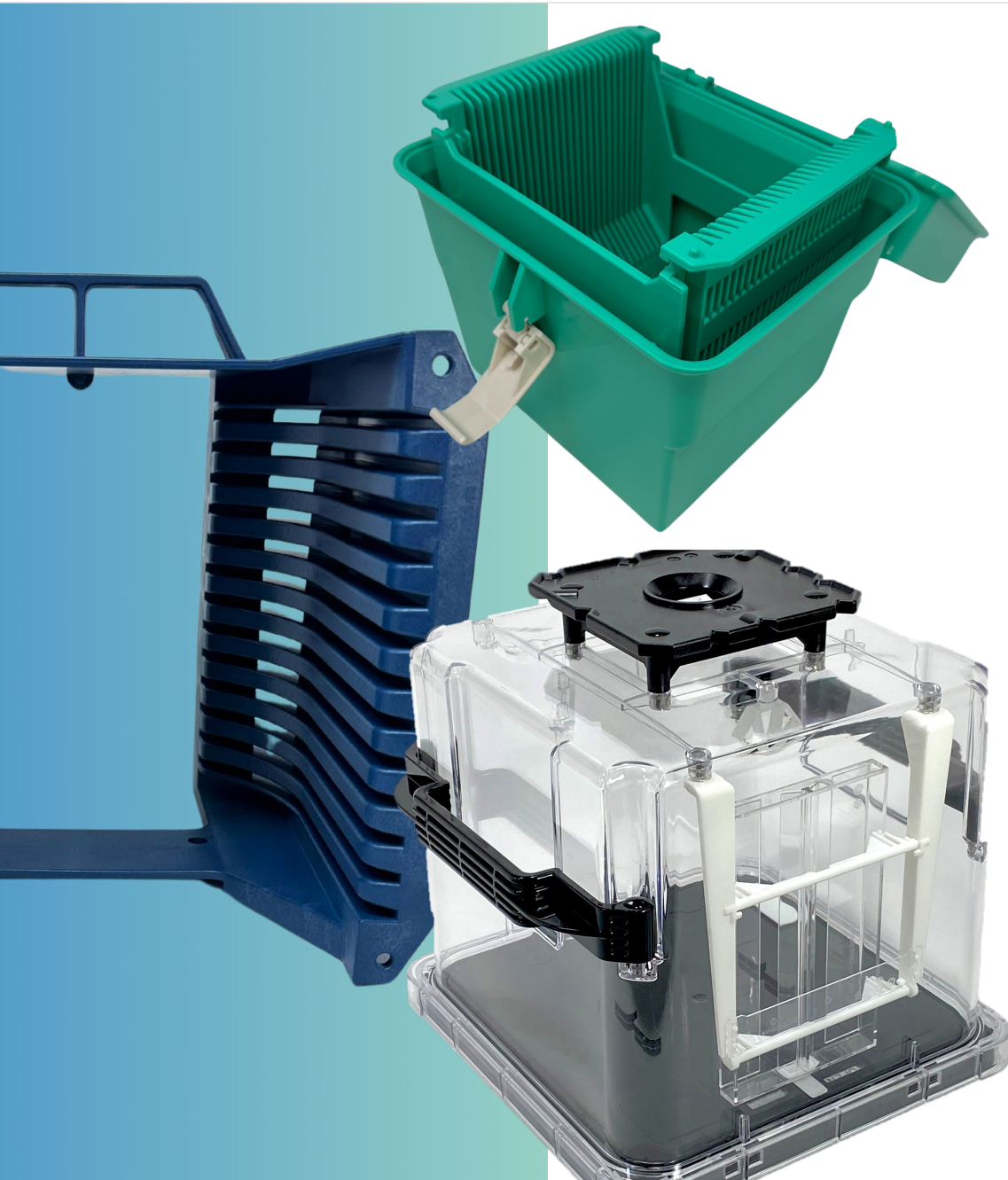
ePAK Products:

- ePRO Raw Wafer Shipping Boxes: Designed to securely transport SiC wafers to processing facilities using our proprietary Dual Row Isolated Cushions.
- overPAKs: Provide additional protection during transit, especially suitable for larger shipments or long-distance transport.

Benefits:

- ePRO Raw Wafer Shipping Boxes and overPAKs are optimized to ensure SiC wafers are protected from environmental factors and mechanical shocks, which are critical during the initial vulnerable stages of handling.





SILICON CARBIDE SOLUTIONS

Epitaxial Growth and Device Fabrication

Process Overview:

- Depositing additional SiC layers on polished wafers.
- Fabricating electronic devices through photolithography, etching, doping, and metallization.

ePAK Products:

- SMIF Style ePOD Pro: High precision container designed for automated handling and storage during device fabrication.
- Process Cassettes: Handle and organize wafers during transport with SiC optimized, low-sloughing materials.
- Storage Boxes: Used for interim storage and organization of wafers during multi-step fabrication processes.

Benefits:

- These products ensure minimal handling errors and protect wafers from contamination with customized solutions for maintaining yield and device performance.

SILICON CARBIDE SOLUTIONS

Shipping of Processed Wafers

Process Overview:

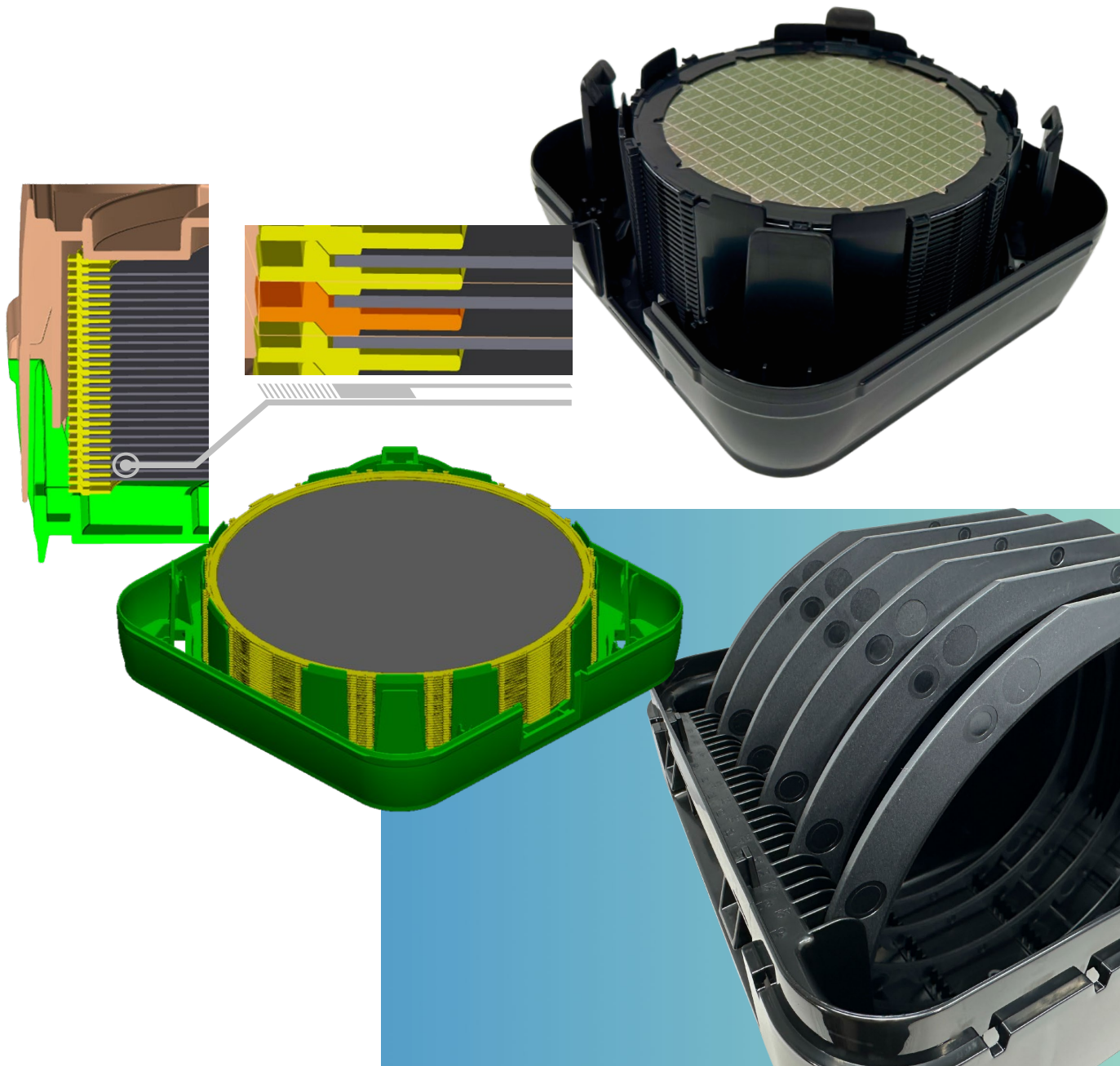
- Preparing and packing fabricated wafers for transport to dicing and packaging facilities.

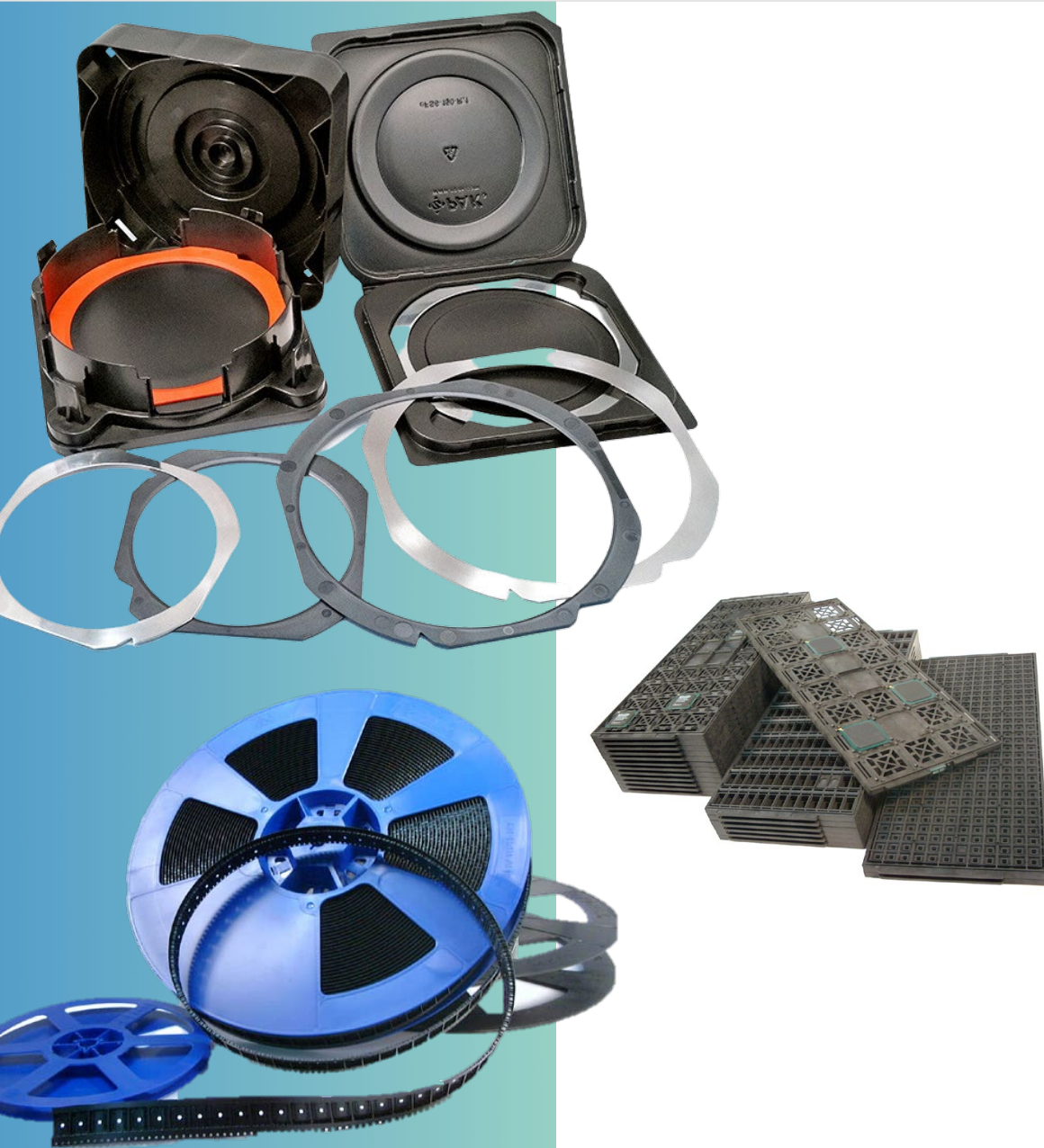
ePAK Products:

- eLX Canister with Fixed Height Ring Separators: Offers customized protection for individual wafers, minimizing contact and potential damage.
- Vertical/Horizontal Frame Shippers: Provides options for securely mounting wafers on frames, facilitating both vertical and horizontal transport configurations depending on the sensitivity and size of the wafer lot.

Benefits:

- These shipping solutions cater to the specific needs of high-value silicon carbide products, ensuring that wafers arrive at their destination in perfect condition with variable lot size capabilities.





SILICON CARBIDE SOLUTIONS

Wafer Dicing and Packaging

Process Overview:

- Cutting wafers into individual chips and packaging them for end-use.

ePAK Products:

- Plastic and Metal Frames, Hoop Rings: Provide structural support during the dicing process.
- JEDEC Trays: Standardized trays for safe handling and transport of diced chips.
- Tape and Reel: Ensures efficient, safe, and contamination-free packaging of individual chips for shipment.

Benefits:

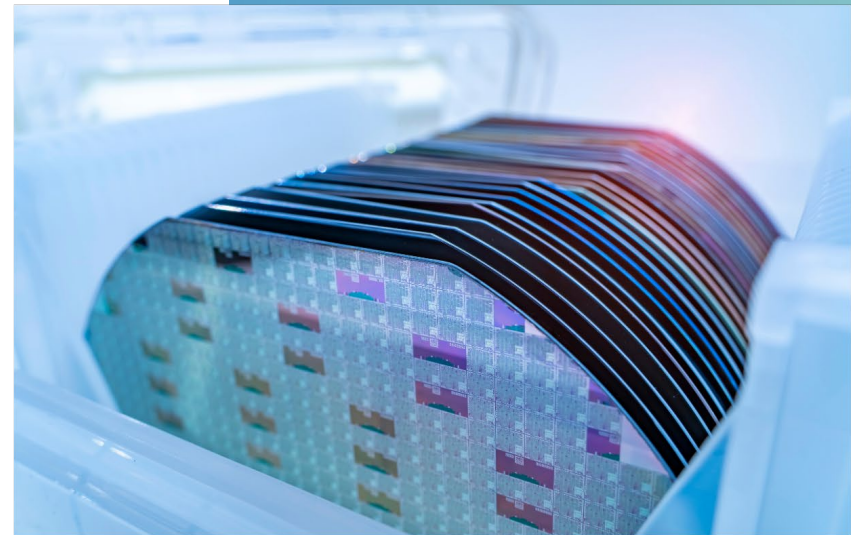
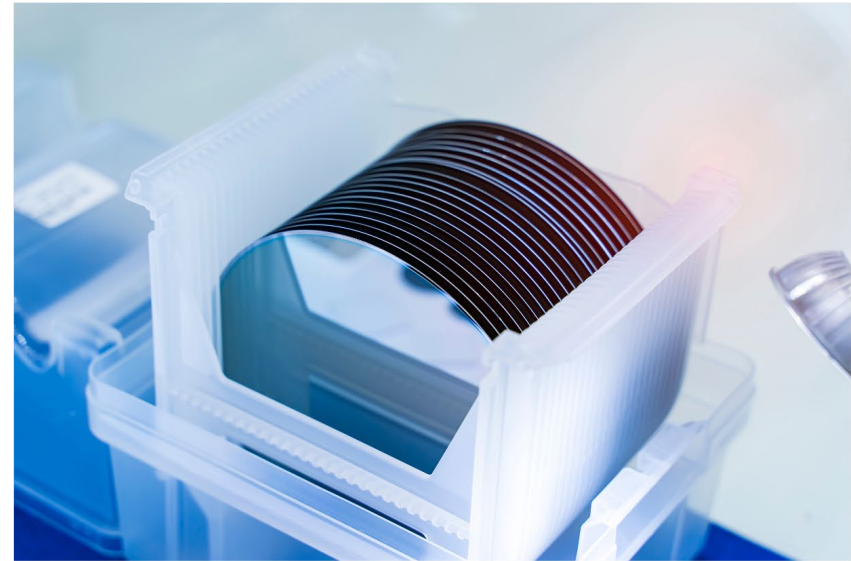
- These packaging solutions are tailored to ensure that chips are protected against physical damage and contamination, crucial for maintaining functionality and reliability in the final products.



eSiC[™] Solutions Catalog

Securing the Future of Silicon Carbide

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SECURING THE FUTURE OF SILICON CARBIDE

eSiC Process Solutions

Boule Storage

ePAK PN	ePAK Description	General Description
eWB0040-ASSY-2-L	eJR4-100-23-ASSY-2-L	100mm x 23mm jar w/ liner - natural PP material
eWB0035-ASSY-2-L	eJR8-200-23-ASSY-2-L	200mm x 23mm jar w/ liner - natural PP material
eWB0586-ASSY-1	eJR6-150-R.4-ASSY-1	6in Jar w/ eLX style latching system
eWB0579-ASSY-1	eJR8-150-51-R.2-ASSY-1	8in Jar w/ eLX style latching system

Process Boats

ePAK PN	ePAK Description	General Description
eWB0135-eM-01-V2-BLK	ePB-6/150-12-eM-01-V2-BLK	150mm Process Boat, 12 slot, PP, Black
eWB0381-N-eM-157-BLK	ePB-6/150-13-N-R.1-eM-157-BLK	150mm Process Boat, 13 slot, PC, Black
eWB0537-eM-157-BLK	ePB-6/150-25-R.21-eM-157-BLK	150mm Process Boat, 25 slot, PC, Black
eWB0101-N-eM-47-BLK	ePB-6/150-25-R.2-N-eM-47-BLK	150mm Process Boat, 25 slot, PEEK, Black
eWB0135-eM-56-NAT	ePB-6/150-12-eM-56-NAT	150mm Process Boat, 12 slot, PVDF
eWB0456-RF-P1-eM-157-BLK	ePB-8/200-25-R.12-RF-P1-eM-157-BLK	200mm Process Boat, 25 slot, PC, Black, RFID
eWB0456-RF-P1-eM-157-BLU	ePB-8/200-25-R.12-RF-P1-eM-157-BLU	200mm Process Boat, 25 slot, PC, BLU, RFID
eWB0425-eM-157-BLK	ePB-8/200-13-R.6-eM-157-BLK	200mm, Process Boat 13 slot, PC, Black
eWB0182-eM-56-NAT	ePB-8/200-13-eM-56-NAT	200mm Process Boat, 13 slot, PVDF

ePOD Pro

ePAK PN	ePAK Description	General Description
eWB0725-ASSY-1	ePOD-PRO8-ASSY-1	200mm Automation Compatible SMIF Style POD

SECURING THE FUTURE OF SILICON CARBIDE

eSiC Shipping Solutions

ePRO Style Shippers

ePAK PN	ePAK Description	General Description
eWB0209-ASSY-25	ePRO III-6/150-25-ASSY-25	150mm Shipping Box, 25 wafer - dual row isolated springs
eWB0283-ASSY-14	ePRO III-8/200-25-ASSY-14	200mm Shipping Box, 25 wafer - dual row isolated springs

overPAK System

ePAK PN	ePAK Description	General Description
eVT1653-eM-26-NAT	eV18-6in ePRO II and ePROIII-2-eM-26-NAT	OverPAK for 150mm ePRO II and ePRO III (holds 2)
eVT1535-eM-26-NAT	eV18-8" ePRO II and ePRO III-2-eM-26-NAT	OverPAK for 200mm ePRO II and ePRO III (holds 2)

eLX Canisters

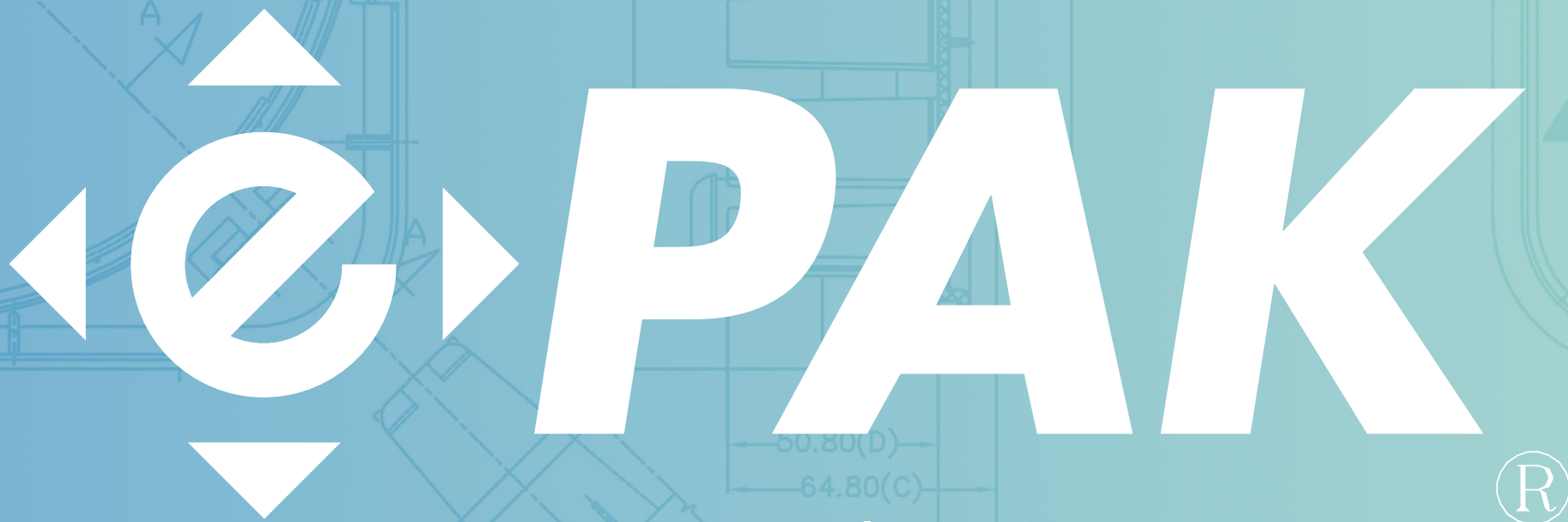
ePAK PN	ePAK Description	General Description
eWB0435-4-ASSY-2	eCT-LX-6/150-4-66-ASSY-2	6in eLX tall canister - conductive PP (black) w 26pcs eRS0023-eM-01-BLK fixed height ring separators
eWB0516-4-ASSY-3	eCT-LX-8/200-4-69-R.3-ASSY-3	8in eLX tall canister - conductive PP (black) w 26pcs eRS0026-eM-01-BLK fixed height ring separators

Vertical Flex Frame Shippers

ePAK PN	ePAK Description	General Description
eWB0591-ASSY-1	eFS8-200-25-R3.-ASSY-1	8in/276mm film frame shipper ePRO style - conductive PP (black)

Horizontal Flex Frame Shippers

ePAK PN	ePAK Description	General Description
eWB0323-ASSY-1	eFSC6-150-40-ASSY-1	150mm Horizontal Frame Canister Shipper
eWB0587-ASSY-1	eFSC8-200-48-ASSY-1	200mm Horizontal Frame Canister Shipper



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