CRYSTAL SONIC

Catalyzing advanced semiconductor manufacturing by harnessing the power of sound.

Plug & Play – Deep Dive – Semiconductor Technology
September 19th, 2024

Arno Merkle, CEO & Co-founder
arno@xtalsonic.com

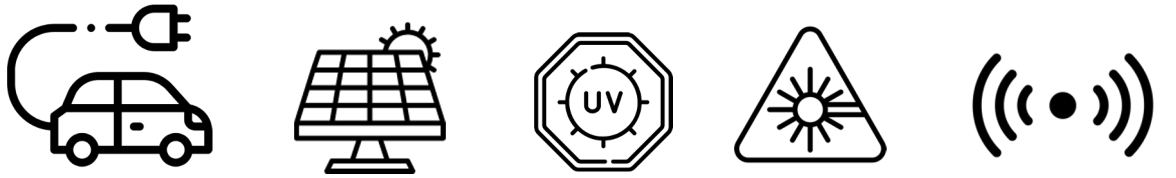
CRYSTAL SONIC

- Phoenix, Arizona
- Arizona State University Spin-off (Bertoni Lab)
- Advanced Semiconductor R&D
- Team of 7

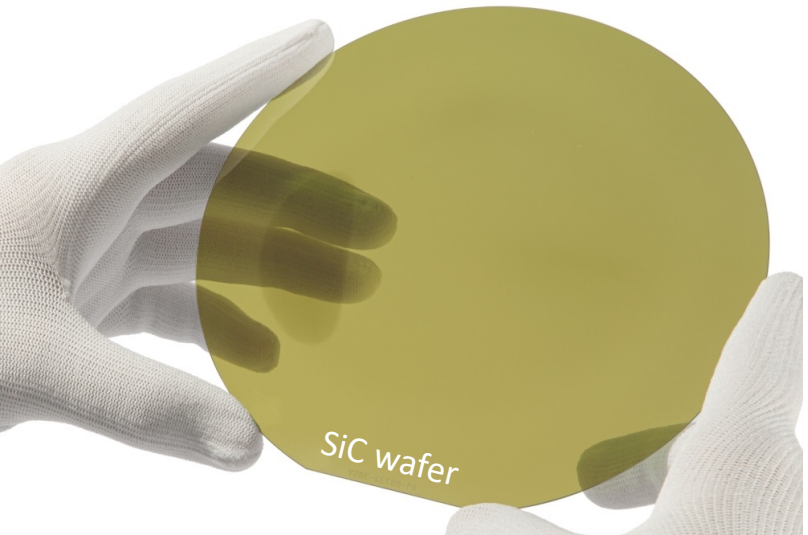
Photo credit: E. Gronek, ASU

New wafer materials are the future…

SiC, GaN, and other wafer materials are rapidly **replacing silicon** addressing **$100B+ device markets.**



…but come at a price.

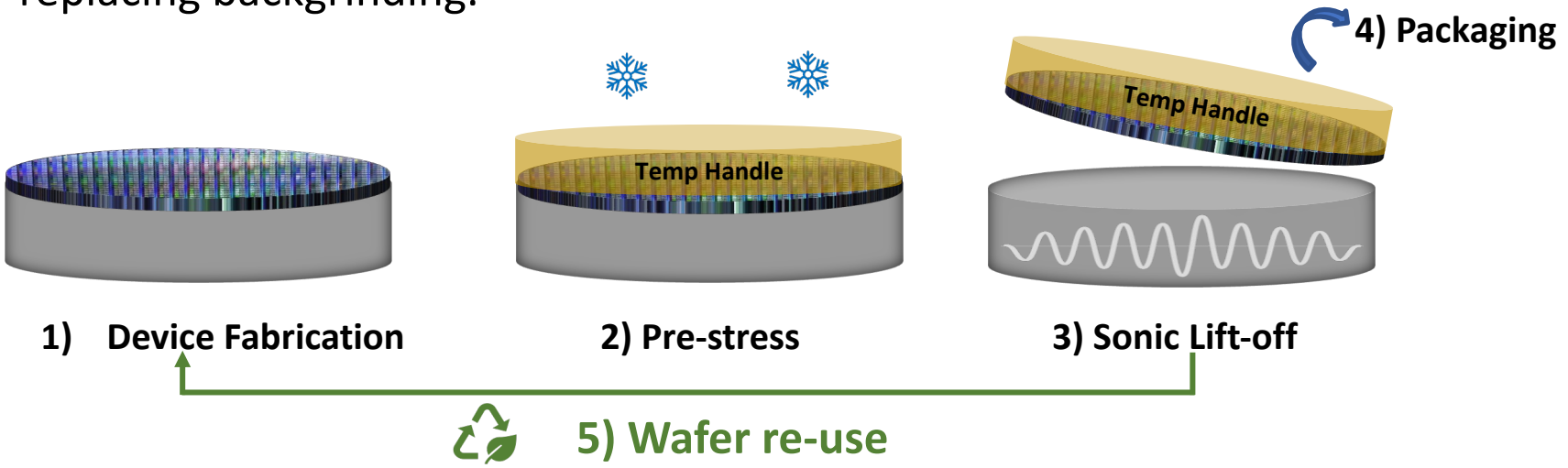


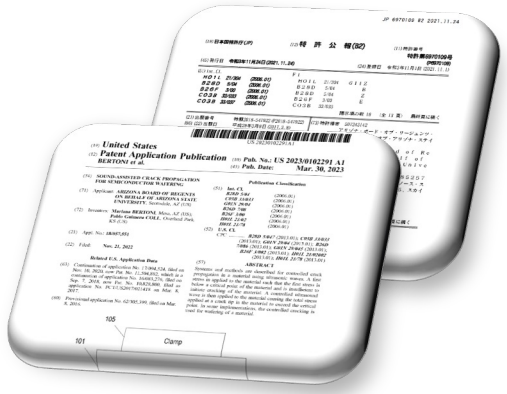
*Wafers are the **#1 manufacturing cost** and **>95% of material is wasted** during manufacturing.*

"The #1, #2 & #3 priority is to reduce SiC wafer cost"
- Power America, 2024

Our Solution: Sonic Lift-off

Sonic Lift-off (SLO) enables **substrate re-use** by employing acoustic energy to release devices from wafers, replacing backgrinding.



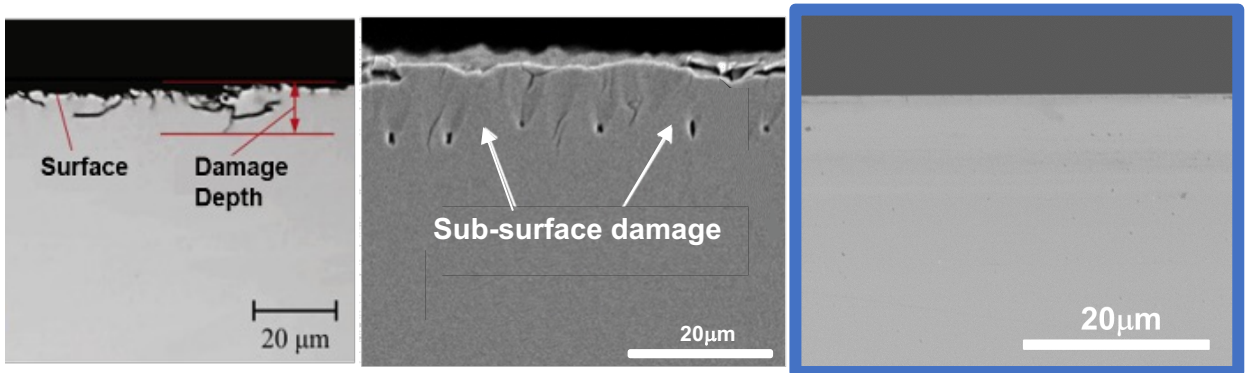


Multiple Patents

Demonstrated:

- ✓High throughput
- ✓Zero damage to devices
- ✓SiC, GaN, GaAs, AlN and Si.
- ✓Scalability

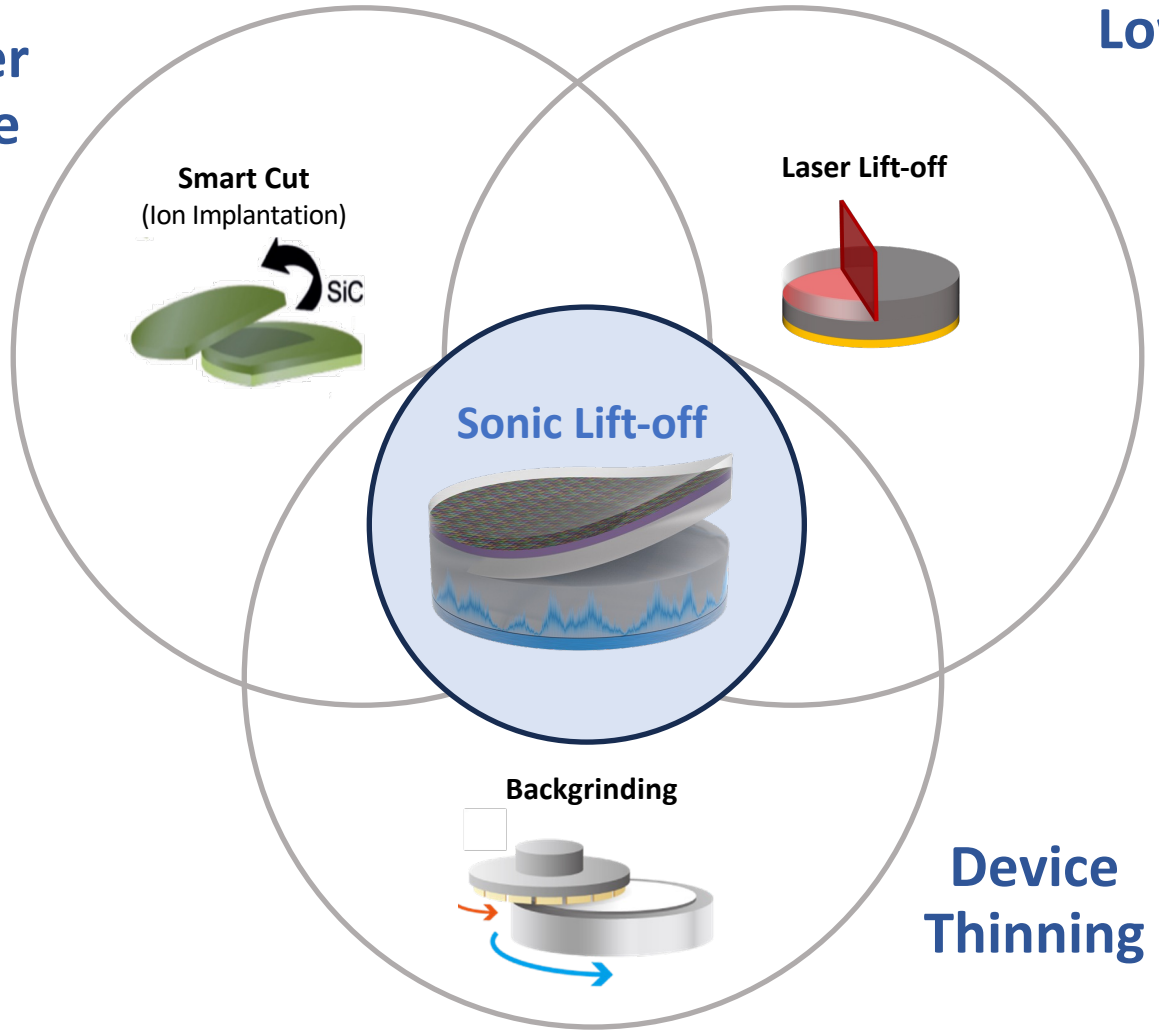
Pristine sub-surface quality: unlike alternatives.



Grinding **Laser** **Sonic Lift-off**

Competitively Differentiated

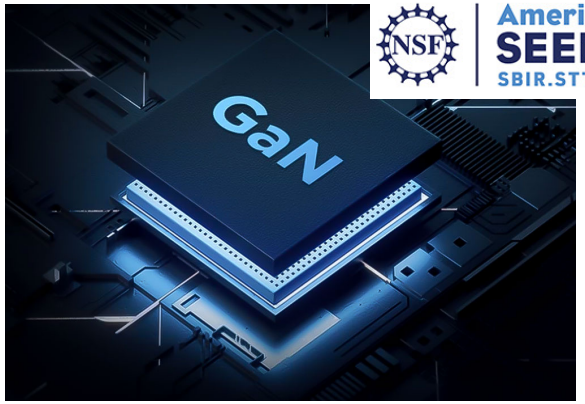
Sonic Lift-off is the only technology to combine thinning, reuse and cost advantages for devices.



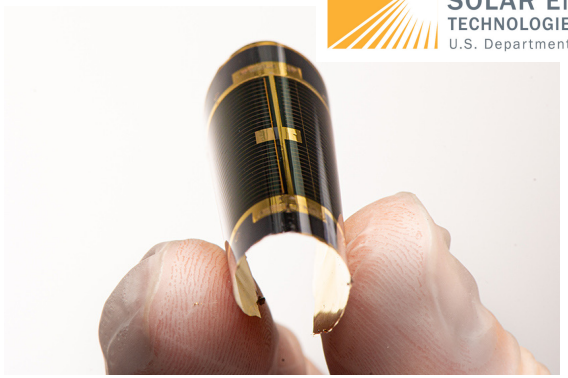
Supported by Leading Organizations

2023-2025: NASA SBIR Ignite – Phase I, II and II-E support for $1.4M to develop sonic lift-off for space photovoltaics.

2024: Grand Prize Winners ($250k) of the Lam Capital Venture Competition out of 70 semiconductor startups.



2023: NSF SBIR Phase I to develop SLO for bulk GaN



2020-24: DOE SETO Sub-award for PV reuse

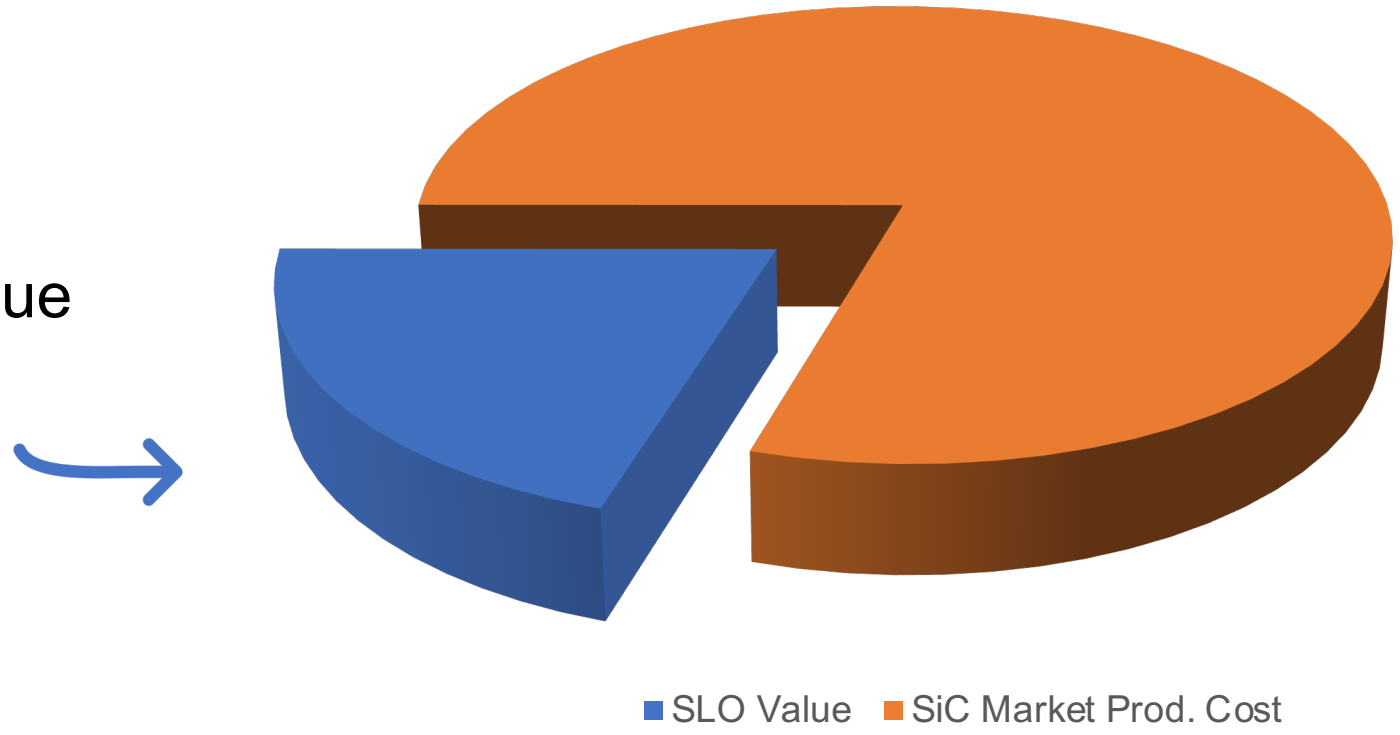
2024: Arizona support for first SiC SLO development steps

+ $13M of additional non-dilutive grants in pipeline.

SiC: Beachhead Opportunity

Sonic Lift-off (SLO) reduces #1 cost for the **$10.4B SiC power device market.**

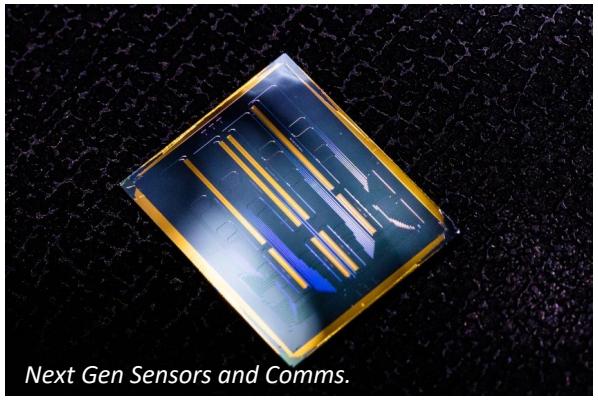
$2B annual **SLO** value delivery by 2029

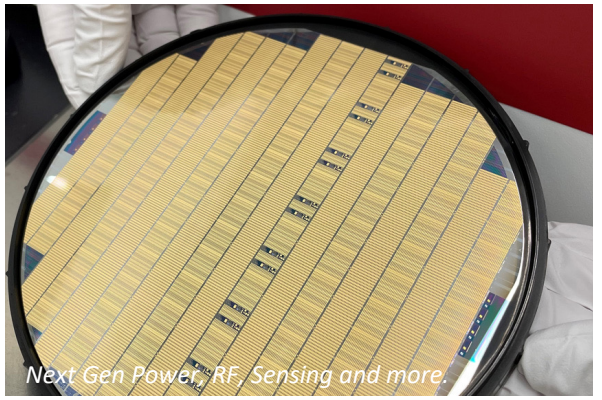


Cost model assumes $90/wafer backgrinding cost and $600/wafer (6”).

Valuable Markets Beyond SiC Power

Sonic Lift-off can address several semiconductor device markets and deliver unique value.





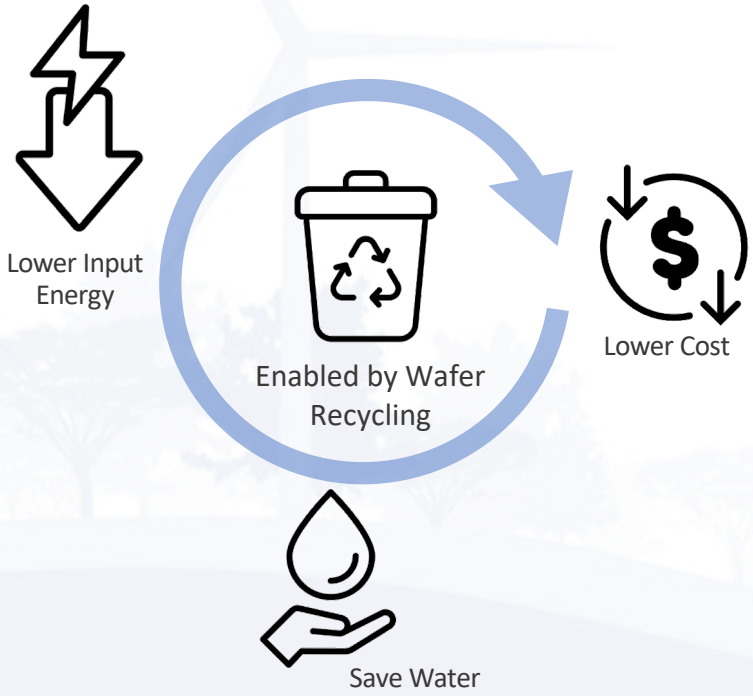
Opportunities	Ultrathin Silicon	Ultrathin LN	Other Wide Bandgap Semiconductors
Market	12" Silicon	4 - 6" Lithium Niobate	GaN, AlN, diamond, SiC (RF), InP
Applications	3D ICs / Integration	Optoelectronics	RF, Sensors, Power
Annual SLO Value Market Potential (2030)	**$2-3B**	**$0.5B**	**$2-3B**

Broader Impact for the Industry

Our tools will enable **sustainable manufacturing** and accelerate the **energy transition**.

Manufacturing

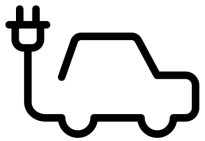
Circular economy for wafer utilization.



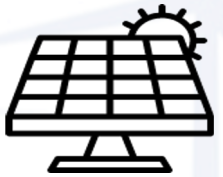
Future SLO Tool

Energy Transition

6 GT CO_2 /year savings by 2050



Electric Vehicles



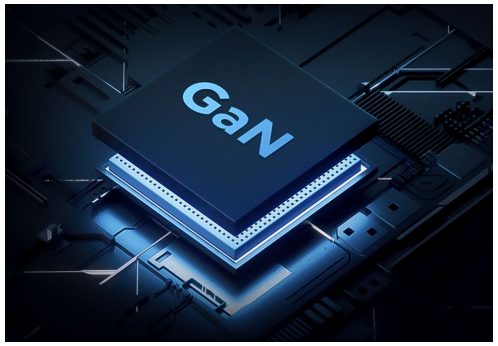
Renewables

Grid

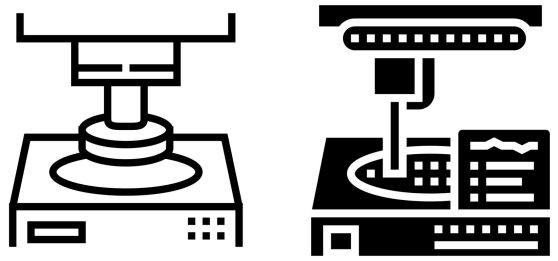
Data Centers

Traction

- Feasibility pilots underway with major SiC device manufacturers.



- Successful feasibility pilot completed with major GaN supplier.



- Engaged with 5 semi equipment manufacturing suppliers.

"SLO technology can be a game changer that can help leapfrog the adoption of WBG devices beyond anybody's expectations today."

- Sr. Executive, Power Electronics Industry

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