2021 OVERVIEW PALLIDUS

High-growth materials company with proprietary and disruptive technology to grow the highest quality, lowest cost, and most consistent silicon carbide (SiC) wafers for power and RF semiconductor devices

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READY TO COMPETE AND WIN Pallidus In Brief

Disruptive Technology	Pallidus' pro technology (Silicon Carbi
Expanding Market	SiC wafer m next 10 year
Leading Wafer Economics	Pallidus will substantially
Broad and Secure IP	Robust IP po to end produ valuable and
Outstanding Potential	Globally exp revenue and lining up for

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oprietary M-SiC[™] material and shaped charge platform will enable it to become a leading supplier of oide (SiC) epi ready wafers

narket **growing at 35% CAGR; \$10 billion opportunity** in ars driven by electric vehicles, clean energy, and 5G

produce wafers at **higher yields and throughputs**, y **reducing wafer and upfront capital costs** by up to 50%

ortfolio covering the full lifecycle from powder to wafers lucts; extensive portfolio of patents supported by d defensible trade secrets

perienced management and technology team; **Rapid** d EBITDA growth starting 2022 and beyond; Customers r wafers.



80,000 SQ.FT. FACILITY LOCATED IN ALBANY, NEW YORK USA **Pallidus Facility**



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PALLIDUS HISTORY **Rapidly Achieving Milestones**

MAY 2015

Pallidus spun out from Melior Innovation to commercialize M-SiCTM source materials for power semiconductor growth applications

Q3 2018

Transitioned to crystal growth and Opened pilot production facility for 6" SiC wafers



Q1 2019

Grew first 15mm tall 150 mm SiC boules; shape and stress not optimal

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Q1 2017

Established pilot production of M-SiCTM source material



Q4 2018

Grew first 6" SiC crystals; John Kurtzweil (former CFO Wolfspeed/Cree) joins Board

Q2 2019

Grew 6" SiC crystals with met prime quality defects and Zero Carbon Inclusions defects

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joins Board as the Chairman



NEXT-GENERATION HIGH-POWER SEMICONDUCTOR DEVICES WILL RELY ON Silicon Carbide as the Key Enabler

SiC: Surging

SiC wafers are the **Deprising** cks for power electronics applications like PFC boost controllers, drivers, AC/DC inverters, DC/DC inverters: all key components of the world's rapidly expanding electrical infrastructure.



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Applications:

- Electric Vehicles
- Green Energy
- 5G Telecom
- Smart Industrials



Benefits:
Energy Savings
Performance Improvement

> Smaller Form Factor (75%)







RAPID TECHNOLOGY ADVANCES WILL SERVE AS **Growth Drivers for SiC Devices**

ELECTRIC VEHICLES

The market potential for SiC devices in electric vehicles will be \$2 billion within 5 years and \$6 billion by 2028

SOLAR ENERGY

An expected 90% CAGR will drive solar SiC device market potential to \$2.1 billion by 2022



RF and 5G

By 2023, RF SiC wafers will be a **\$1.3 billion market**, with a 23% CAGR driven by telecom and military applications





INTENSE GROWTH IN SIC DEVICES CREATES THE Beginning of an Explosive Market Opportunity



SiC Devices: \$15B to \$20B by 2030 (\$3-\$4B in RF) SiC Wafers: \$7B to \$10B potential within 10 years



International commitments to electric vehicles, clean energy and consumer demand for 5G will push power semiconductor and RF device markets beyond \$20B

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12+ month supply backlog for 6" SiC wafers. Limited suppliers can't meet demand



Customers are highly motivated to qualify new suppliers; incumbent wafer suppliers compete directly with their customers by producing SiC devices



DEMAND FOR WAFERS DRIVING INVESTMENT AND CREATING **Massive Industry Momentum**

" Several suppliers of SiC devices feel that the supply chain infrastructure is not in place to handle the anticipated aggressive forecast ramp up. More suppliers of good quality blank 150mm SiC wafers are required to keep up with growing demand.

-- Richard Eden, analyst, IHS Markit

June 2018 Rohm announces \$540 million investment to increase SiC production capacity 16x by 2025.

November 2018 Infineon agrees to pay **\$150 million** for SiC wafering technology firm Silectra

January 2019 ST Micro announces \$250 million SiC wafer supply agreement with Wolfspeed. January 2020 Deal doubled to \$500 million

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Marcy, NY, 100 miles west of Albany

December 2019 ST Micro completes acquisition of small SiC producer Norstel for **\$137 million** to secure some internal wafer & epitaxy capacity

March 2020 SK Siltron completes acquisition of Dupont's SiC business for **\$450 million** at an estimated multiple of >15x revenue



THE PALLIDUS M-SICTM TECHNOLOGY PLATFORM CREATES **A Step Change in Wafer Economics**



HIGHER QUALITY

- Fundamentally improved, proprietary source material
- Perfect SI:C ratio eliminates carbon inclusions and reduces defects



FASTER GROWTH

- Unique "shaped charge" capability grows longer crystals faster
- Growth process minimizes source material waste

M-SiCTM: EXTREMELY MORE **EFFICIENT AND SIMPLER GROWTH** PROCESS

At scale, Pallidus expects to produce 6" SiC wafers at 20%-30% lower unit costs with up to 50% lower capex requirements vs. industry averages

BETTER YIELDS



- Highly capital efficient process maximizes throughput of source material
- Premium crystal quality means better wafer yields per ingot

FUTURE PROOF



- Scale-up and future process optimizations will sustain margins, even as prices soften over time
- Accelerated product development up to 5x faster than competitors



M-SICTM TECHNOLOGY ADDRESSES INDUSTRY-WIDE CHALLENGES WITH **Pallidus Customer Solutions**





Wafer Availability

Reducing the current 12-18 month backlog for SiC wafers, lack of supplier options

PALLIDUS SOLUTIONS

Pallidus will scale production capacity to ~240,000 wafers per year by 2023

Quality & Consistency

Increasing device yield per wafer; eliminating waste caused by wafer defects

 $M-SiC^{TM}$ technology and reduces wafer defects and increases wafer consistency, upping device yield per wafer

Wafer Cost

Lowering SiC wafer costs to drive wider SiC device adoption in growing markets

Product Development

Next generation wafers to enable innovation in SiC device market

M-SiC[™] platform enables Pallidus to competitively price to market by increasing throughput, reducing yield loss and lowering capex

M-SiCTM technology platform enables faster development of new products including 6" RF & 8" power semi wafers



INTENSE GROWTH IN SIC DEVICES MAKES SIC WAFERS A \$7+ Billion Market Opportunity



40% CAGR EXPECTED

SiC Devices: \$5b by 2022 SiC Wafers: \$3b within 10 years



SUPPLY CONSTRAINTS

12-18 month supply backlog for 6" SiC wafers. Limited suppliers can't meet demand



DEMAND DRIVERS

International commitments to electric vehicles, clean energy and consumer demand for 5G will push power semiconductor and RF device markets beyond \$20b



HUNGRY CUSTOMERS

Customers are highly motivated to qualify new suppliers; incumbent wafer suppliers compete directly with their customers by producing SiC devices

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* Market size estimates based on consensus market research forecasts (Yole, Maia, etc) and company info

Driven by Electric Vehicles, 5G and Industrial power applications and International commitments for clean energy



SEPARATE MAJOR MARKET FOR SIC WAFERS POISED TO TRIPLE **Growth Driver: RF & 5G**



By 2023, RF SiC wafers will be a **\$1.3 billion market**, with a **23%** CAGR driven by telecom and military applications.

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OPPORTUNITY TO UNSEAT INCUMBENT SUPPLIERS:

- In US, only Wolfspeed and II-VI serve this market.
- Customers asking for new suppliers to avoid buying wafers from device manufacturing competition
- New suppliers must be in US due to national security

KEY DRIVERS:

- Insatiable need for bandwidth, new 5G network
- High-performance defense and aerospace systems





DESPITE INTENSE DEMAND, SUPPLY LAGS BECAUSE Sicis incredibly hard to grow

and even harder to do so cost-efficiently. Pallidus' proprietary new M-SiCTM technology solves growth and production challenges, putting Pallidus on the fast-track to becoming a leading supplier of high-quality SiC wafers.

PALLIDUS' UNIQUE AND PROPRIETARY Technology Platform Disrupts the SiC Market

M-SiCTM Source Powder

- Highest purity (6-9s)
- Stoichiometrically balanced
- Uniform and small particle size
- Lower temp beta phase SiC

M-SiC TM Shaped Charge.

- Tailored shapes control isotherms
- Higher packing density for bigger boules
- Open porosity for highest material utilization
- Stable and consistent source drives repeatable growth of highest quality SiC

Pallidus enables the tightest control of SiC growth in the industry

Tailored Simple Growth System

- Fewer HZ components that last longer
- Repeatable consistent recipes that take advantage of stable shape charge
- Growth at lower power with lower defects

Predictive Modeling

- Stable source, simple system, stable growth
- 1000s of iterations specific to Pallidus system
- Predictability produces results in fewer growth runs
- More controllable knobs for faster development





runs nt

PALLLIDUS INTEGRATED TECHNOLOGY PLATFORM **Delivers Powerful Disruptive Advantages**

Highest Material Quality; Consistently

- Fewer defects improves boule and wafer yields
- Consistent wafer quality improves epitaxy and device yields

Repeatable Stable Crystal Growth

- Consistent boule geometry for repeatable material quality
- Lower stress delivers more prime quality wafer material per boule

Longer Boules Grown More Efficiently

- Higher source material utilization
- Better SiC material yields
- Higher throughput per furnace

Lower Cost SiC Wafers and SiC Devices

- More wafers per boule and per furnace
- Fewer defects increases wafer yields
- Better quality wafers increase device yields driving lower device costs

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UNPARALLELED SIC CRYSTAL GROWTH ADVANTAGES START WITH OUR **Powerhouse Source Powder**

Pallidus' proprietary M-SiCTM source material technology **converts faster**, **more efficiently and more consistently** into high quality SiC crystals.

All powder produced internally at Pallidus. Producing 1,000kg/yr now. Will scale production to match crystal expansion plans.

Pure & Balanced

99.9999% pure, balanced 1:1ratio of Silicon to Carboneliminates contaminants andcarbon inclusions

High Utilization

Nearly entire source material converts to crystal and higher packing density enable longer boule growth at lower cost



Faster Growth

Material sublimates faster
creating a homogenous, lowdefect crystalline structure,
improving boule-to-wafer
yield

Consistent Quality

Uniform and clean sublimation produces excellent quality crystal from top to bottom of boule and across entire wafer.



A BREAKTHROUGH GROWTH PARADIGM IS HERE Enhanced SiC via Shaped Charge

Our unique, proprietary M-SiC[™] shaped charge technology enables better control of growth performance and enhanced wafer yields. All shaped charges are produced internally in Albany and can be scaled efficiently along with powder production

Bigger Boules

Densely packed, high porosity, engineered shaped charge technology results in larger boules by facilitating efficient sublimation throughout growth and maximum use of material

Better Yields

Dust-free shaped charge prevents detrimental Carbon Inclusions and improves wafer yield. Higher quality growth at lower sublimation temperatures gives more high quality wafers per boule with fewer grain boundaries

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Consistent Quality

99.999% pure, balanced 1:1
ratio of Silicon to Carbon
eliminates contaminants. Uniform
and clean sublimation produces
excellent quality crystal from top
to bottom of boule.

Larger Diameters

Controlling the geometry of the Shaped Charge allows Pallidus to tightly control radial and axial gradients, to grow crystals under lower stress Pallidus is better poised to rapidly deliver 150mm and expand to 200mm diameter ulitizing our Shaped Charge technology



PALLIDUS HAS DRAMATICALLY IMPROVED OUR BOULE AND WAFER Quality Surpassing Premium Wafer Specifications

Consultant working with Pallidus - former Chief Scientist at Dow Corning Compound Semiconductors "Working with the Pallidus technical team for the last 16 months they have made significant strides with their PVT process. Most notably the last six months has delivered large advancements in SiC crystal quality. I have reviewed much data in this period and it is clear their new learning has delivered step change improvement in crystal growth yield and defect reduction. The current PVT process is performing in the 150 mm diameter range. The crystals produced in this recent period now show dislocation density values that are competitive with the commercially available product from the legacy SiC wafer suppliers." "This is very important as now with a more consistent process it is easier to continue tuning the process and gain further improvements in yield, quality and repeatability. The Pallidus team has accelerated their rate of progress significantly in the last six months. Based on my experience related to the evolution of SiC crystal growth learning, I expect the team to continue to make large advancements in the foreseeable future."

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CAREFUL PLANNING AND PREPARATION MEANS Pallidus is Ready to Grow





Demonstrated repeatable Ultra-**Premium** material quality wafers

Wafer quality being validated by **multiple** epitaxy and device customers

First long-term supply agreement in place (\$47MM), second agreement in queue (\$53MM)

Strong customer pull worldwide

Patents in place globally; technology and production process protected by trade secrets

Technology **nearly** impossible to reverse engineer

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First production facility ready to scale

Supply chain is aligned and has capacity to grow with Pallidus

Second facility specifications defined and sites being vetted

Core technical and operational team in place

Key positions identified and specs created; funding will initiate recruiting and hiring



vast ip portfolio and superior technology positions pallidus for **Rapid, Protected Development**

Pallidus' intellectual property is **strong and fully protected**. Its M-SiC[™] platform provides unique and sustained advantages for large diameter wafer product development, driving innovation at **1/4 the development time of competitors.**

IP covers **all phases** of Pallidus' business, including downstream products

Owner of 16 issued patents; 6 in US, 10 international. Applications pending for 32 US and foreign patents

Exclusive license to 10 US patents; 31 US pending and 31 foreign pending applications

Trade Secrets at every process step provide the strongest and most comprehensive IP protection

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Ask for more information

www.Pallidus.com

