

Overview of eFutures Network+ and Impacts

eFutures Network+

Beth McEvoy

Futures (foresight) researcher (Queen's University, Belfast); Co-Lead, eFutures4.0.





EFUTURES

SIGNALS TODAY.
SOLUTIONS TOMORROW.

Network Overview



Who We Are

eFutures is the EPSRC-funded national
Network+ for electronic systems.

We are based out of Queen's
University, Belfast; and run through to
2030.



Project lead: Hamza Shakeel

Co-Leads: Beth McEvoy; Maire O'Neill, Ciara Rafferty.

Network Managers: Natalie Magill, Sean Morrison, Arinze Uchenwa

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What We Do

Our portfolio of activity ranges from staging international conferences and workshops; to targeted events in the UK; online and in-person bespoke support; and undertaking research projects to help inform policy and the wider research landscape.



Who We Serve

The community of academics working in this space, creating opportunities for them across institutions and across disciplines; facilitating international partnerships and partnerships with industry.



Why It Matters

The Network's overarching goal is to build and strengthen UK electronic systems research; preserve and grow the UK's international reputation in this critical sector; and support work towards Government objectives and targets.

Impacts

REPORTS

In-built research expertise;
Neuromorphic Report led to multi-million-pound funding calls;
Semiconductor Landscape Report reports had >800 participants totaling > 7000 hours engagement. based on 7,000 total hours of participation.

COMMUNITY

Engagement from 70 UK Universities;
20 UK universities on our Steering Group and major industry partners.

1000 members.

Dedicated ECR support programme.

Sector-leading Women's Programme.

EVENTS

Over 85 events delivered with 5000 attendees (2019-2026);

Two international conferences, with 70 speakers from >15 countries, directly generating £47 of grant income for every £1 spent

Impact

Novel Compute Architectures

Report (2021) generating £19.5 million + in funding opportunities (2022-25)

EFUTURES

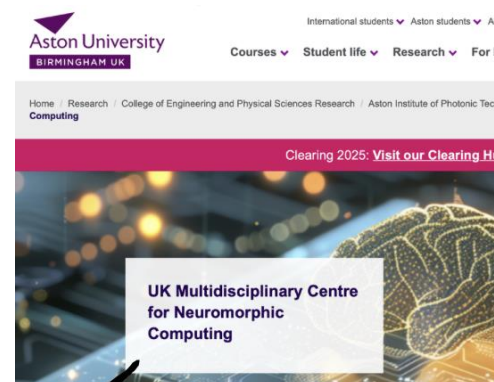
The UK Landscape in Artificial Intelligence and Brain-Inspired Computing Hardware: the potential for establishing a new Centre of Excellence

August 2021

GIACOMO INDIVERI,
UNIVERSITY OF ZURICH AND ETH ZURICH

WALID NAJJAR,
UNIVERSITY OF CALIFORNIA, RIVERSIDE

Funding opportunity	
UK Multidisciplinary Centre for Neuromorphic Computing	
Opportunity status:	Closed
Funders:	Engineering and Physical Sciences Research Council (EPSRC)
Funding type:	Grant
Total fund:	£5,600,000
Maximum award:	£5,600,000
Publication date:	4 September 2024
Opening date:	10 September 2024 9:00am UK time
Closing date:	5 November 2024 4:00pm UK time



UCL to lead UK's brain-inspired computing innovation centre

19 September 2025

The UK's first Innovation and Knowledge Centre (IKC) dedicated to neuromorphic (brain-inspired) computing hardware will be led at UCL with £12.8 million funding from the Engineering and Physical Sciences Research Council (EPSRC).

Neumat Network: Neuromorphic Materials and Devices for Future AI Hardware

Lead Research Organisation: [UNIVERSITY OF CAMBRIDGE](#)
Department Name: Materials Science and Metallurgy

Semiconductors



Semiconductor Video



Chips 2040

What

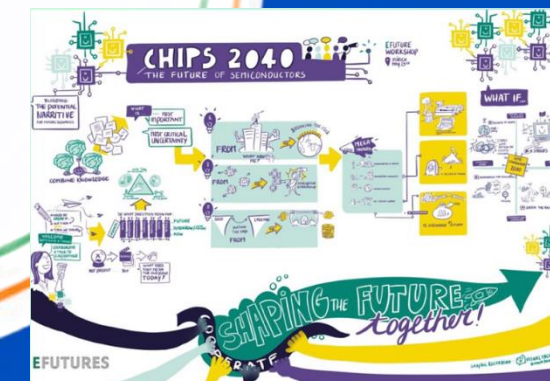
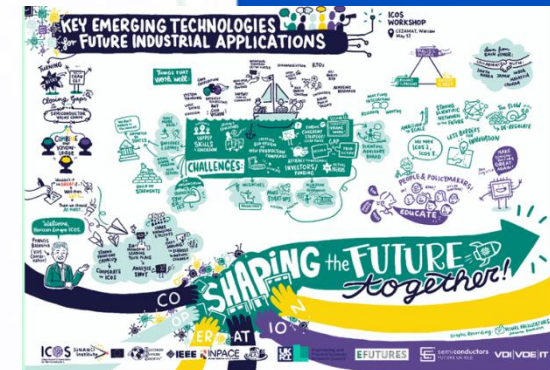
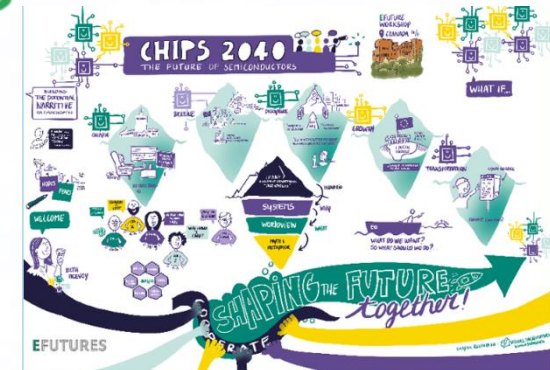
A UKRI-funded strategic foresight piece of research, building scenarios for semiconductors in 2040.

Who

Led by Beth McEvoy, with workshops in Dublin, Granada, Helsinki, and Warsaw, and more to come in Glasgow (160+ international participants - research, industry, policy, and academia - with semiconductor-related expertise)

Why

In order to help inform today's strategic decisions for UK funding and directions in semiconductors.



2026-2030

Building Communities of Practice in:

- Advancing Semiconductor Materials
- Designing and Modelling Novel IC Architectures
- Realising Hybrid and Heterogenous Systems

Support for collaborations, especially **international** and **interdisciplinary**

Visits and Workshops, in support of skills and talent, women, and building grant income for UK

Australia; Canada; Finland; France; Germany; Italy; Japan; Norway; Sweden and more

Conferences

Belfast, August 2027 (Futures track)

Dublin 2028

TBC 2030

Application Areas

Climate Change, Future Compute, Health, Mobility, Space

1 Prioritisation

The UK Government should prioritise the following themes of semiconductor technology, based on strong academic R&D foundations and future potential. Investments need to promote high risk, high reward research, as well as converting existing excellence into scalable, sustainable technology with a commercial outcome:

Advancing Semiconductor Materials

Particularly compound and 2D semiconductor materials to the point of manufacture, where we can bring our excellence in materials research into developing new types of designs and models for circuit design; identify new materials for making highly energy-efficient, performance-driven, and cost-efficient electronics; and create connections between materials, devices, and systems research communities.

Designing and Modelling Novel IC Architectures

Particularly circuits and architectures for future compute, e.g. neuromorphic, and cryo-CMOS (quantum), modelling cybersecurity by design, and design for future power electronics, to the point where we can scale all these designs into viable systems.

Realising Hybrid and Heterogenous Systems

Particularly the design, development and integration of silicon photonics (necessary for neuromorphic and quantum compute) and sensors for manufacturing, medical, agricultural, environmental, energy, and other applied sectors; chiplets, System on Chip (SoC), and System in Package (SiP), e.g. co-packaged optics for future AI, comms, and big data; and advanced packaging for power electronics.

A multidisciplinary UK research community aligned to this theme must be fostered, promoting R&D on seamless integration of diverse semiconductor components and technologies; and the cognate critical supply chains engaged.

Thank you

efutures@qub.ac.uk



Opportunities for (Ultra)Wide Bandgap Semiconductors: From University Research to Commercialization

REWIRE

Professor Martin Kuball

Director of the REWIRE Innovation and Knowledge Centre (IKC), University of Bristol



Opportunities for (Ultra)Wide Bandgap Semiconductors: From University Research to Commercialization

Martin Kuball

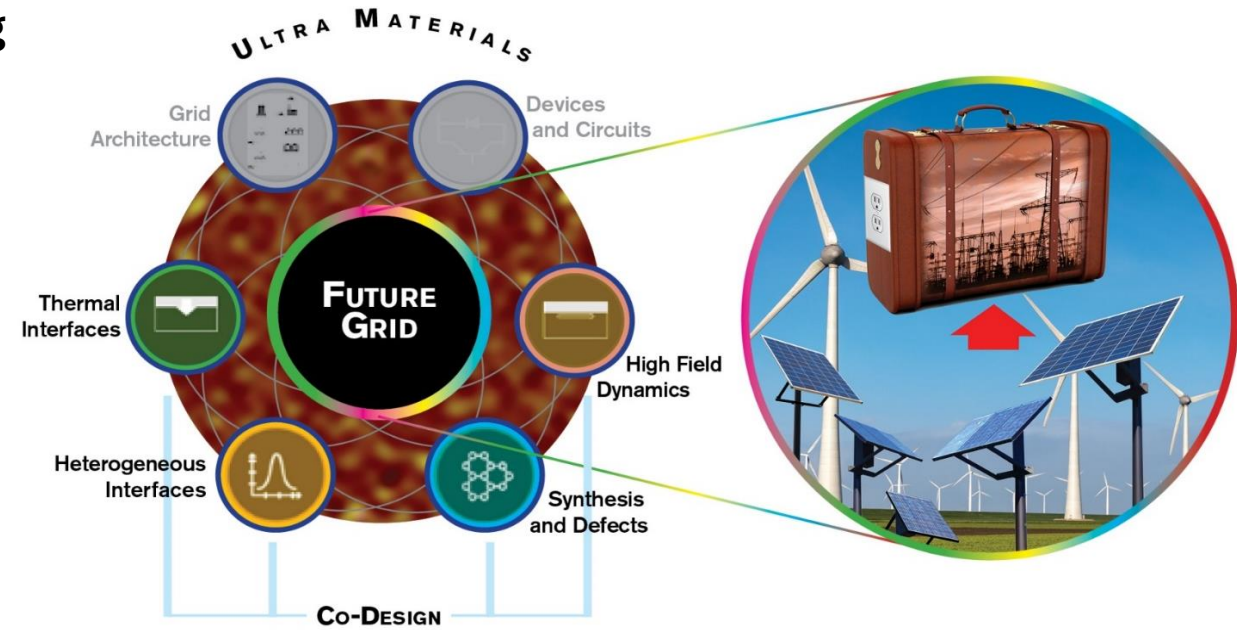
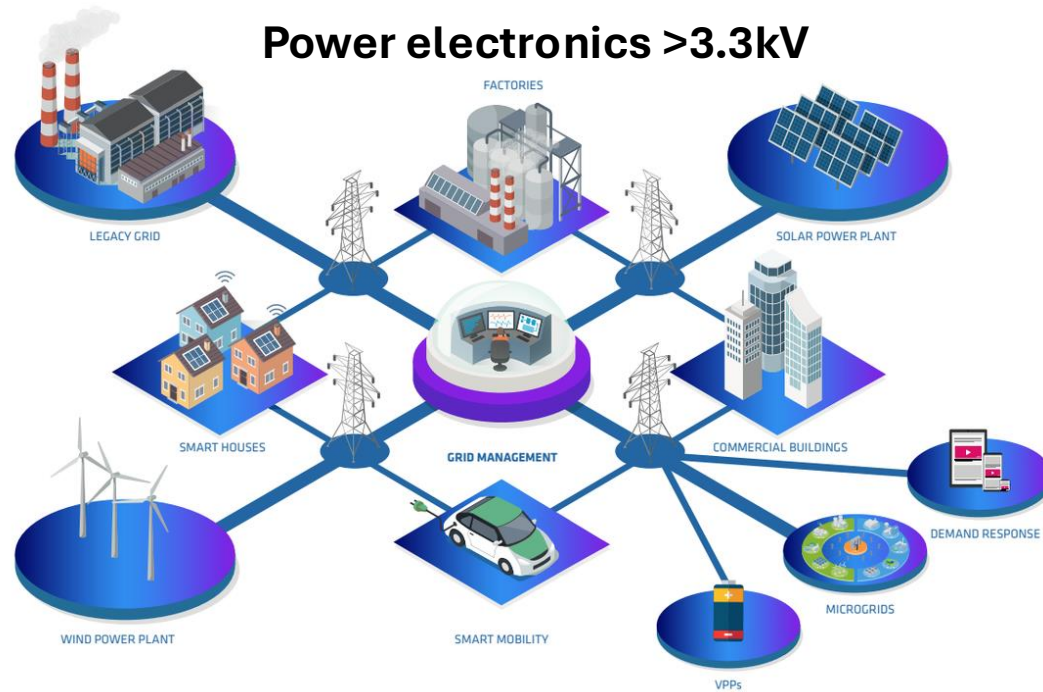
Royal Academy of Engineering Chair in Emerging Technologies,
University of Bristol, UK



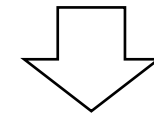
REWIRE

Why wide/ultrawide bandgap (WBG/UWBG) materials?

Power management for NetZero, efficiency heat sinking



School-bus-sized neighbourhood power transformer stations



Suitcase-sized converters

Our Aim: Higher voltage, higher efficiency than current technology

Are there better solutions than Si and SiC for power applications?

£11m Innovation and Knowledge Centre

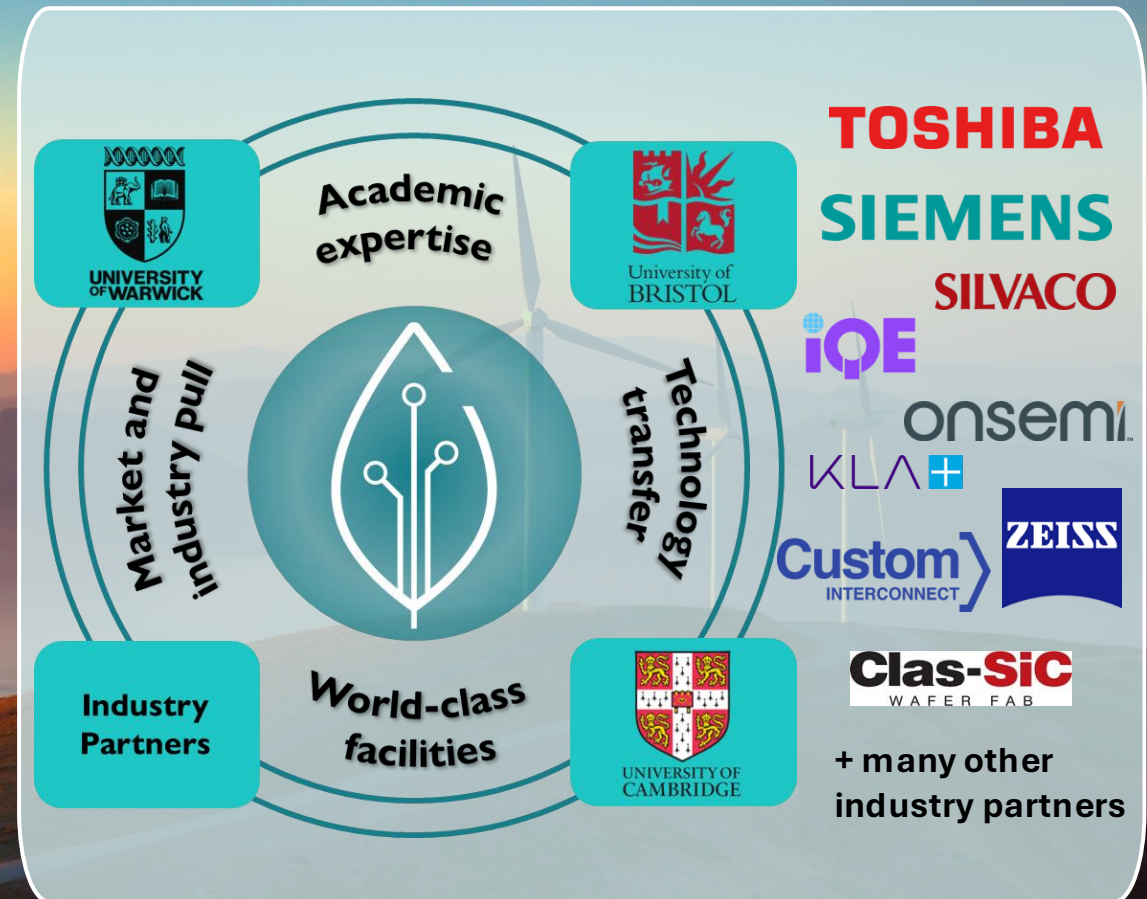
*The next generation of power semiconductors:
from concept to commercialisation*



REWIRE

rewire-ikc.org

- Innovation and **co-development with industry; driven by market needs**
 - **Impact and engagement** across supply chain
-
- Three University consortium – **Bristol, Cambridge and Warwick**; 18 academics, 100+ researchers – **ONE REWIRE VOICE**
 - Go-to centre of excellence for **wide and ultra wide band gap power semiconductors**



WBG power devices for Net Zero



Harnessing wide- and ultrawide-bandgap semiconductors to revolutionise our lives

Electrification



Emission reduction



Pushing scientific frontiers



5-minute EV charging



Green public transportation



Resilient HVDC energy grids

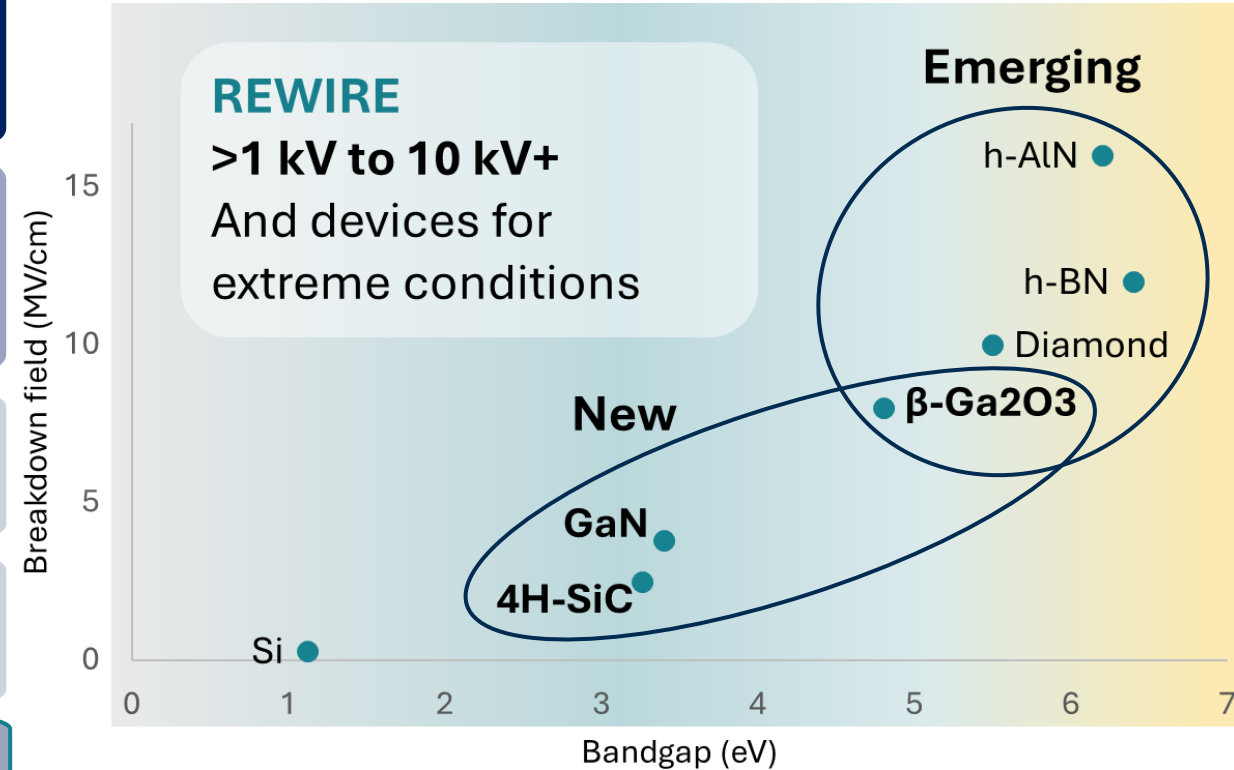


Enabling space exploration

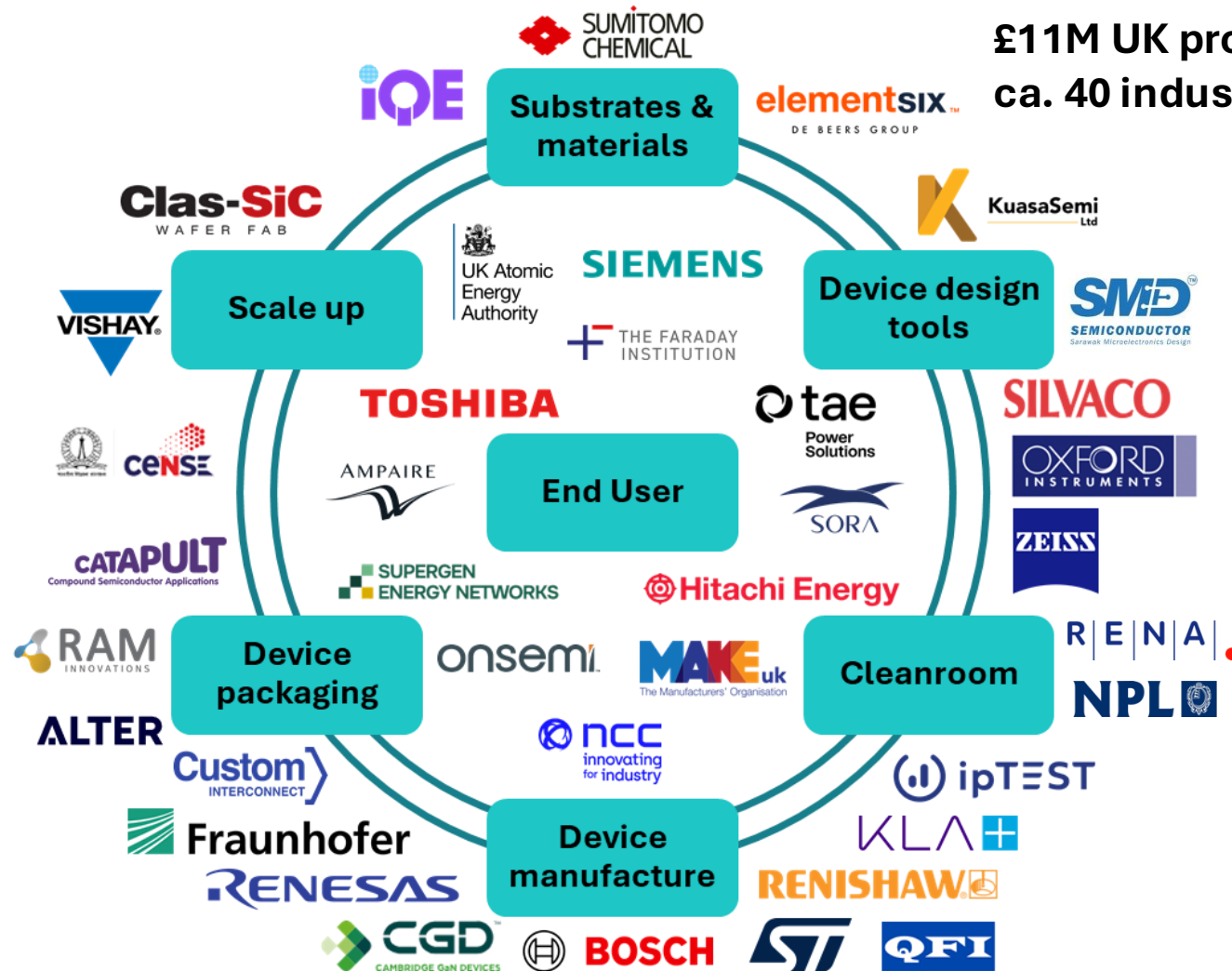
Silicon carbide (SiC)

Gallium nitride (GaN)

Gallium oxide (Ga_2O_3)



Co-develop technology with industry



Engaged with over 100 businesses, RTOs, academic institutions and sector bodies, **including several multiple industry partners working on active REWIRE collaborations and projects**



TRANSLATE UNIVERSITY RESEARCH IN SEMICONDUCTORS INTO THE COMMERCIAL SPACE

From Discovery to Real-World Impact



UNIVERSITY RESEARCH: THE SOURCE OF INNOVATION



- Pushing the boundaries of knowledge
- Developing novel materials, devices and architectures
- Training the next generation of engineers
- Solving long-term, societal challenges

Great ideas start in the lab.
Their impact begins when they reach the world.

THE TRANSLATION BRIDGE

Turning Potential into Products



COMMERCIAL SPACE: REAL-WORLD IMPACT

Enabling better chips and systems

Powering the products we use every day

Driving energy efficiency and sustainability

Strengthening the economy and creating high-quality jobs

Improving lives and solving global challenges

Research has the power to change the world.
Translation makes it happen.

WHY IT MATTERS



ACCELERATE IMPACT
Move breakthroughs from years or decades to real-world solutions.



STAY COMPETITIVE
Strengthen national and industry leadership in semiconductors.



CREATE VALUE
Generate economic growth through innovation, startups and partnerships.



INVEST IN PEOPLE
Provide students and researchers with real-world experience and opportunities.



BUILD A BETTER FUTURE
Enable technologies that improve lives and address global challenges.



BRIDGE THE GAP. AMPLIFY INNOVATION. CREATE IMPACT.
Your research can do more than advance knowledge — it can build the future.

World-leading REWIRE Facilities



Facilities for design and simulation, growth, fabrication, packaging and device testing up to the converter level



Access our world-leading power semiconductor facilities

Across our three partner academic institutions, we have state-of-the-art facilities with world-leading and unique capabilities to provide complete device fabrication and testing, from the material level through to packaged prototype devices.

Access the REWIRE facilities

Ga_2O_3 : Our growth and fabrication capability



Gallium Oxide Agnitron MOCVD



Seki Diamond CVD system
(installed in July 2026)

State of the art cleanroom



Opportunities

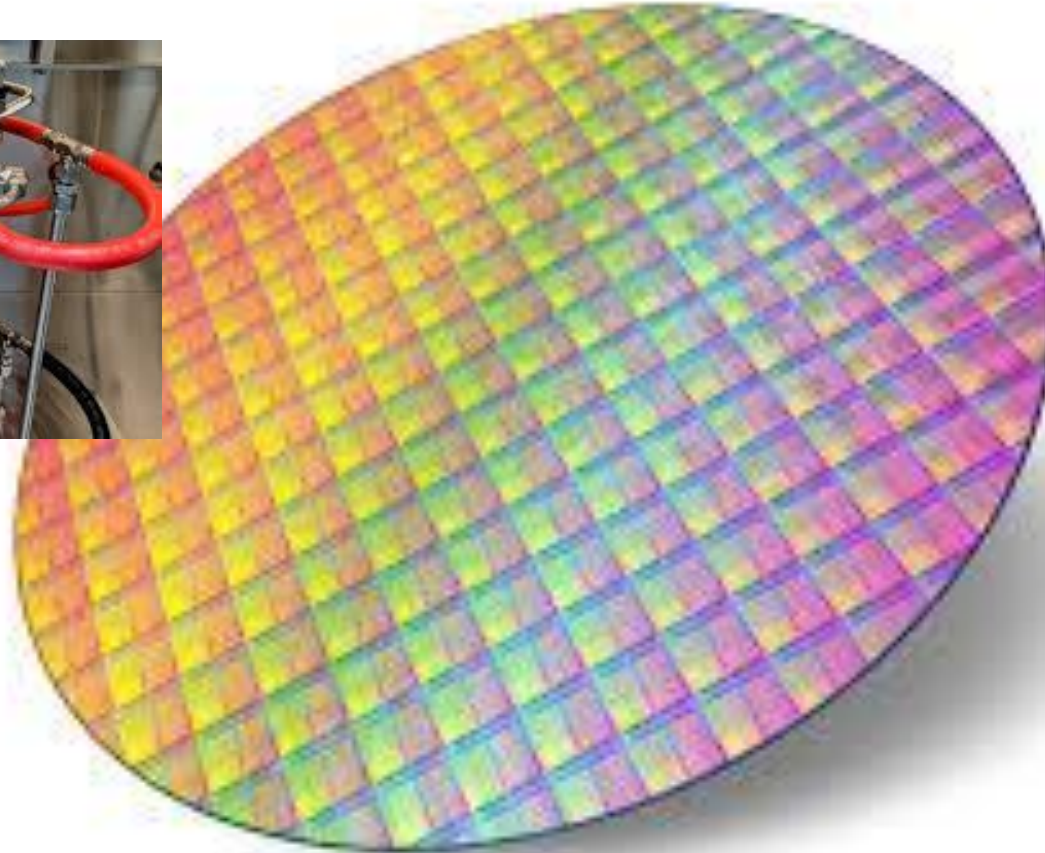
- High voltage capability

Challenges

- Low thermal conductivity
- Only workable doping – n-type
- Low electron mobility

Next generation power electronics: β -phase Ga_2O_3

Gallium Oxide on Si technology that is scalable



Next generation
energy grid



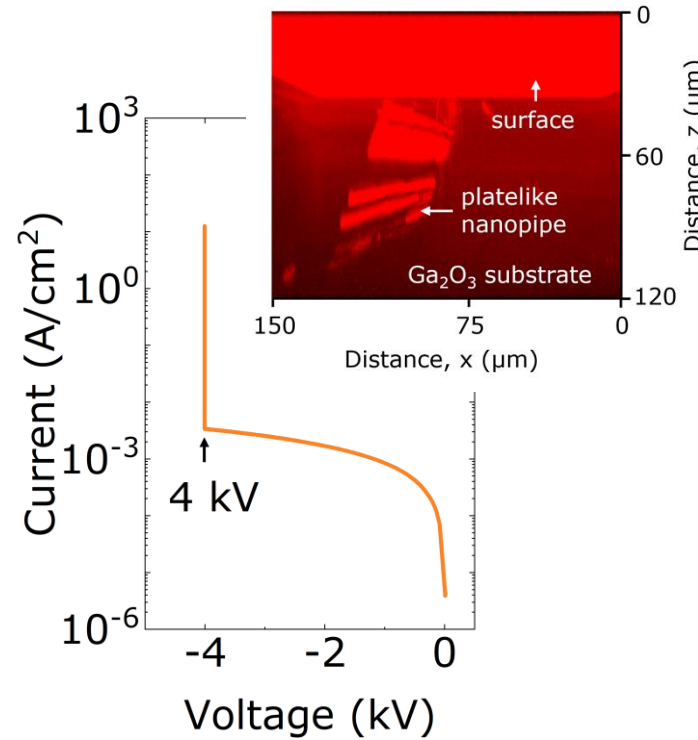
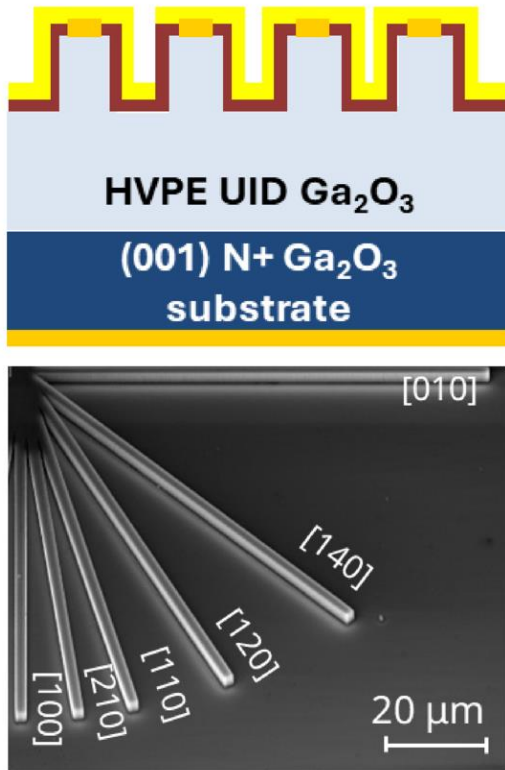
Radiation hard electronics



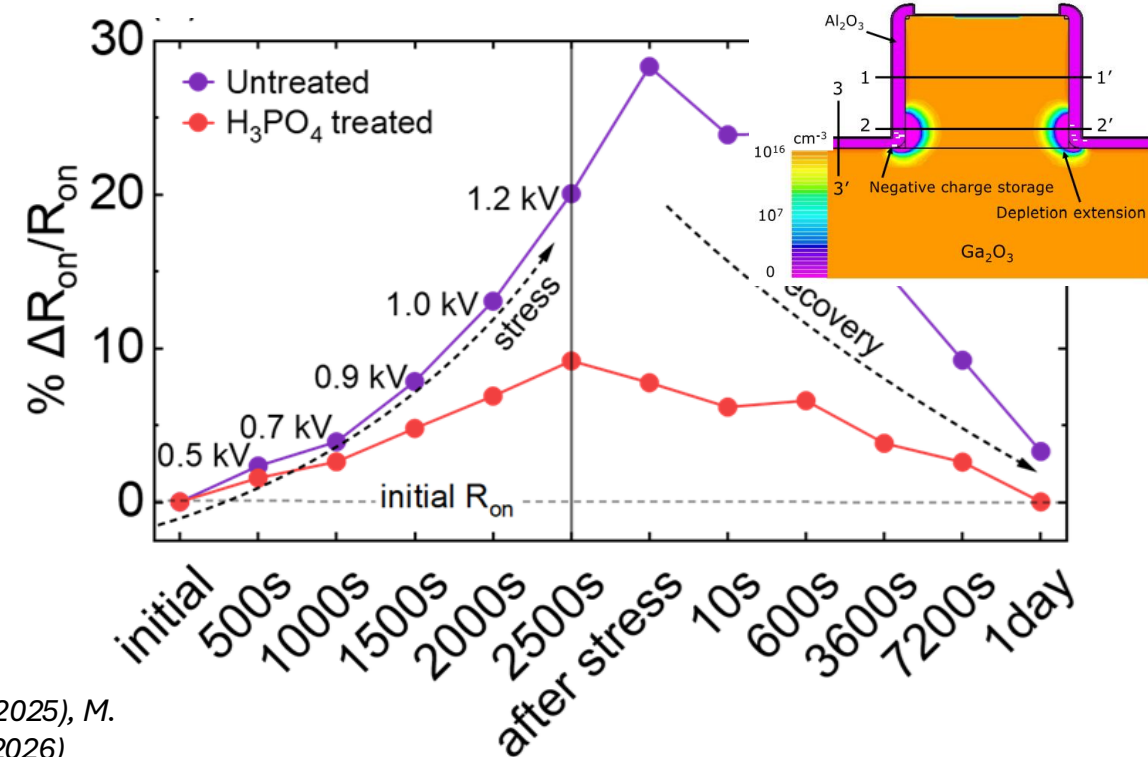
Next generation
of EV chargers

IP filed & setting up spin-out

Reliable >4 kV β -Ga₂O₃ diodes: Demonstrator

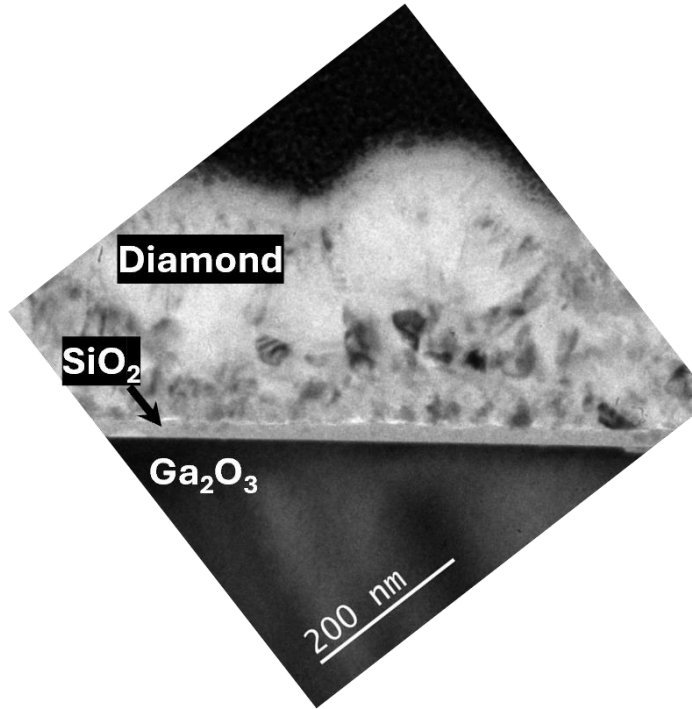
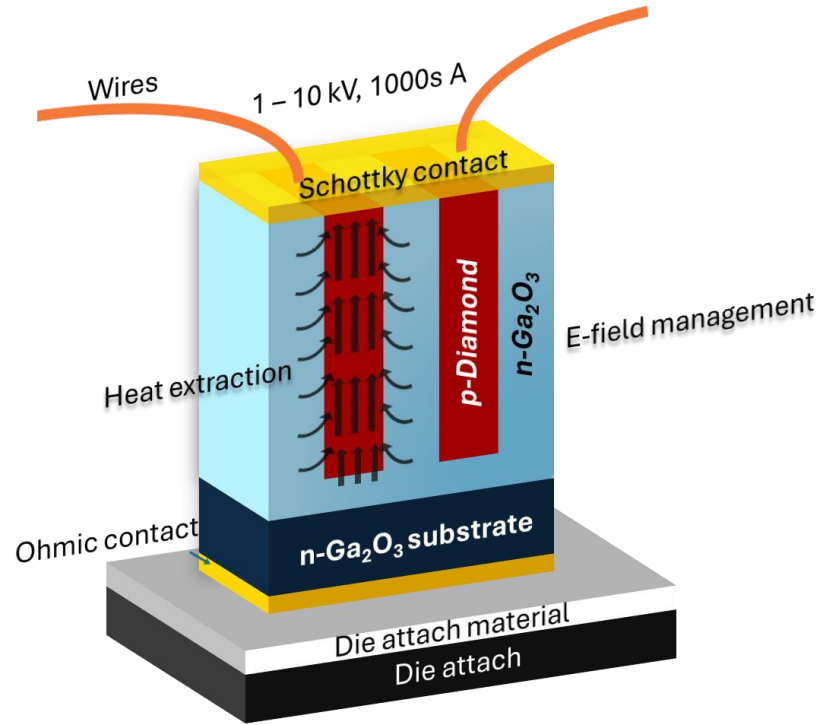


Eg. S. Charan et al. Appl. Phys. Lett. 126, 163502 (2025), M. Kim et al., accepted for ACS Electronic Materials (2026)

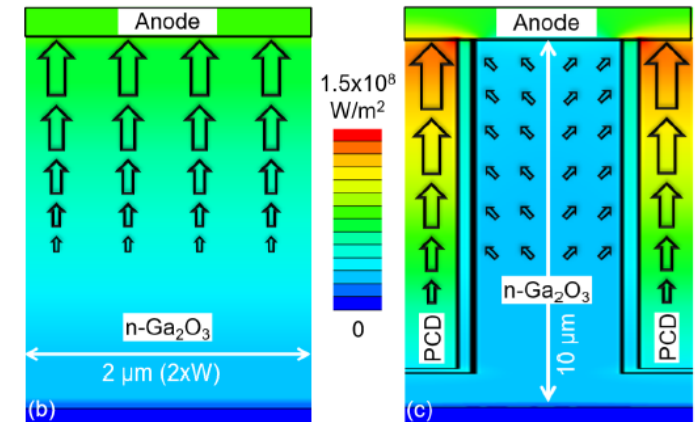
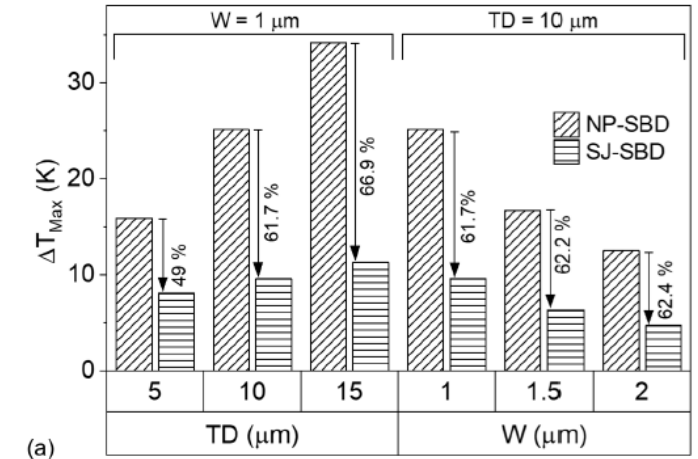


Good breakdown characteristics, and decent reliability, which may be surprising considering how early Ga₂O₃ is in the tech development.

Ga₂O₃ – Diamond TSBD: Improve heat sinking



Alternating trenches of n-Ga₂O₃ and p-diamond in the TSBD architecture **not only** contribute to a 60% reduction in the temperature rise but also enable operation below the breakdown voltage limit of Ga₂O₃

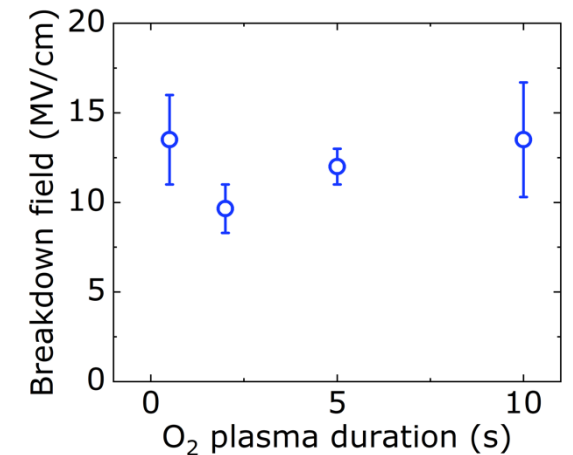
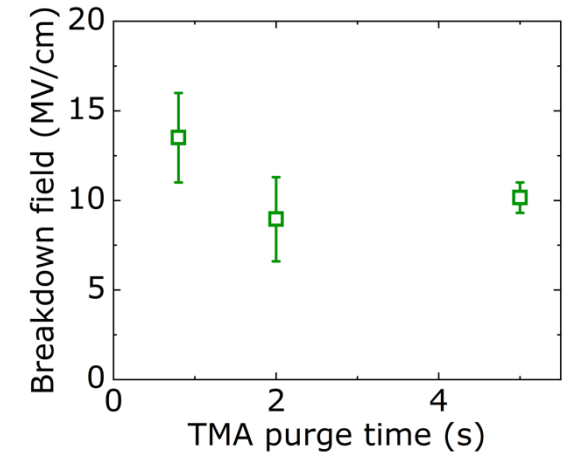


Mishra A. *et al.* IEEE Trans. on Elec. Devs. 2021, 68, 10, 5055-5061. <https://doi.org/10.1109/TED.2021.3108120>

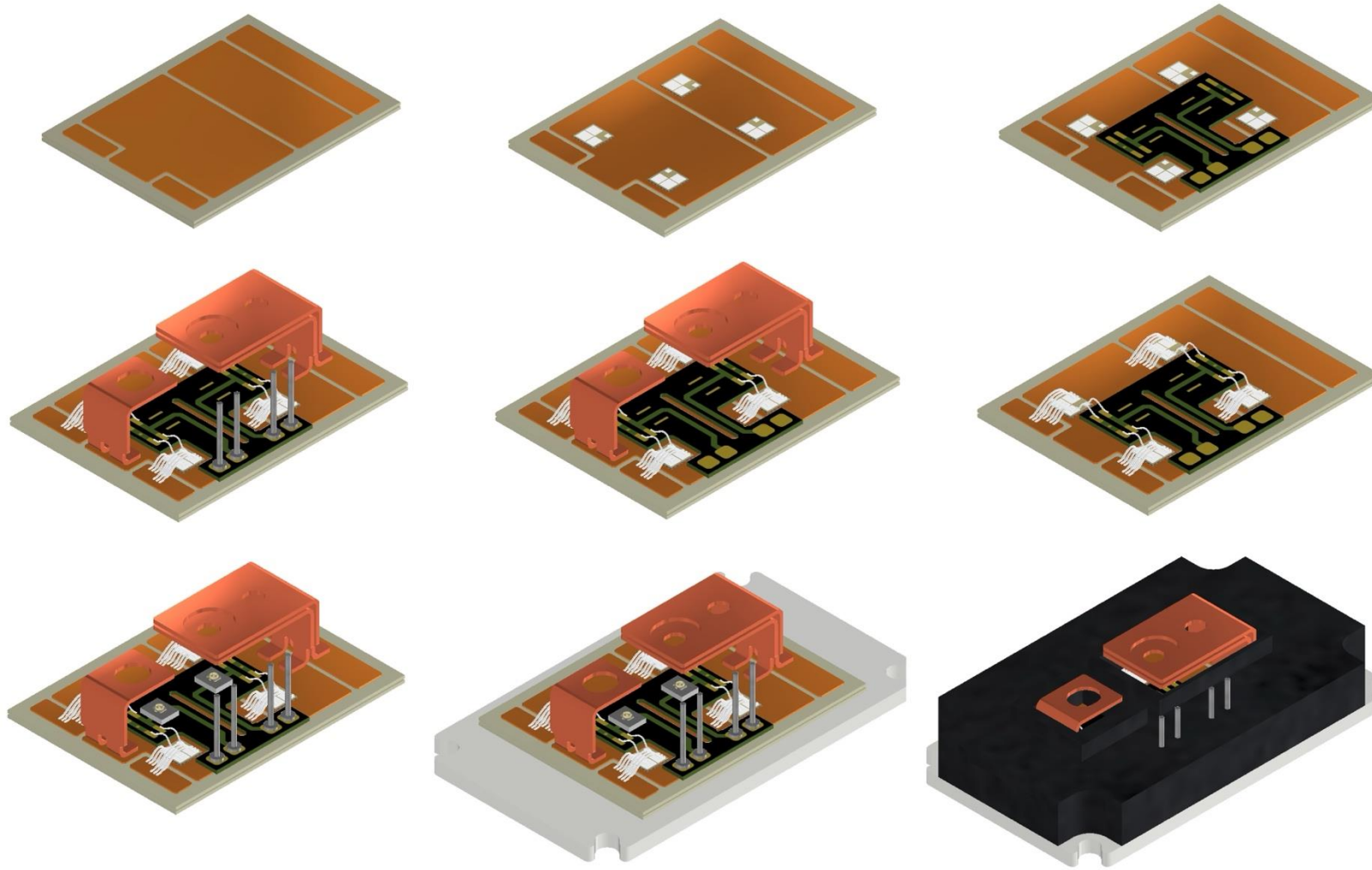
ML tool development for processing



Example of ALD of Al_2O_3



New high-voltage package solutions needed !

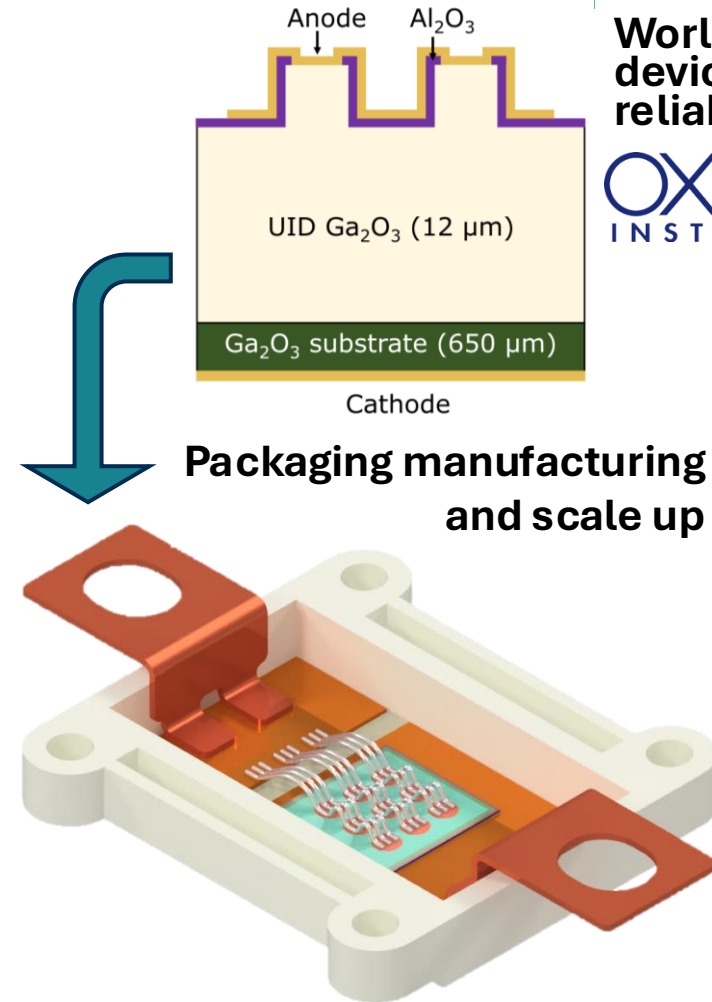


Industry collaboration – Ga₂O₃ devices



REWIRE (Bristol) collaborating with Custom Interconnect (CIL) on packaging for HV Ga₂O₃ devices

- Builds off multiple historic industry project developments (OIPT, ZEISS, NCT)
- Working with CIL to transfer new knowledge into industry for future device technologies
- Industry partners are being lined up for testing devices



World leading Ga₂O₃ devices with excellent reliability

OXFORD
INSTRUMENTS

Novel Crystal Technology, Inc.

ZEISS

Custom
INTERCONNECT



Building on history of translation to industry

2007

Fundamental research

Proved active gate driving for GaN ICs



Engineering and Physical Sciences Research Council



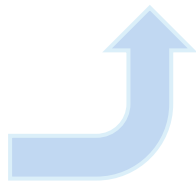
Active gate driver IC for GaN

2017 (with university and industry partners)

Scaling & collaboration

Application to high power GaN converters

First GHz current sensors, sampled to 50+ organisations



SIEMENS Gamesa RENEWABLE ENERGY

TOSHIBA

2023 (APC consortium)

Industrial translation

Applied to automotive & wind power (MW-scale)

Adapted to industry constraints



Onwards

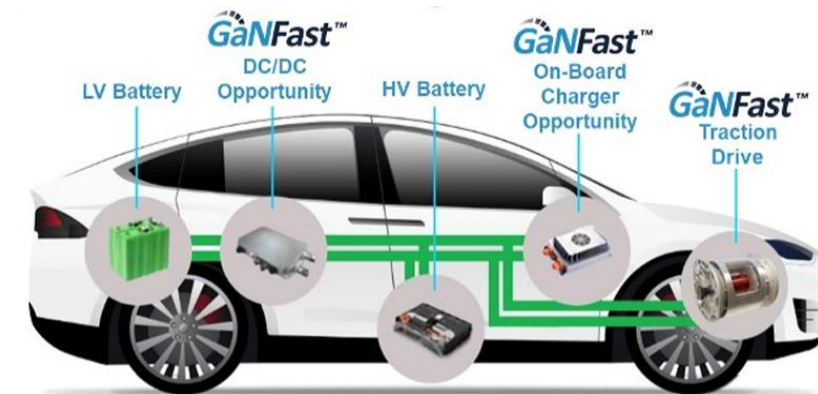
Commercial adoption

40+ organisations (incl. Formula 1)

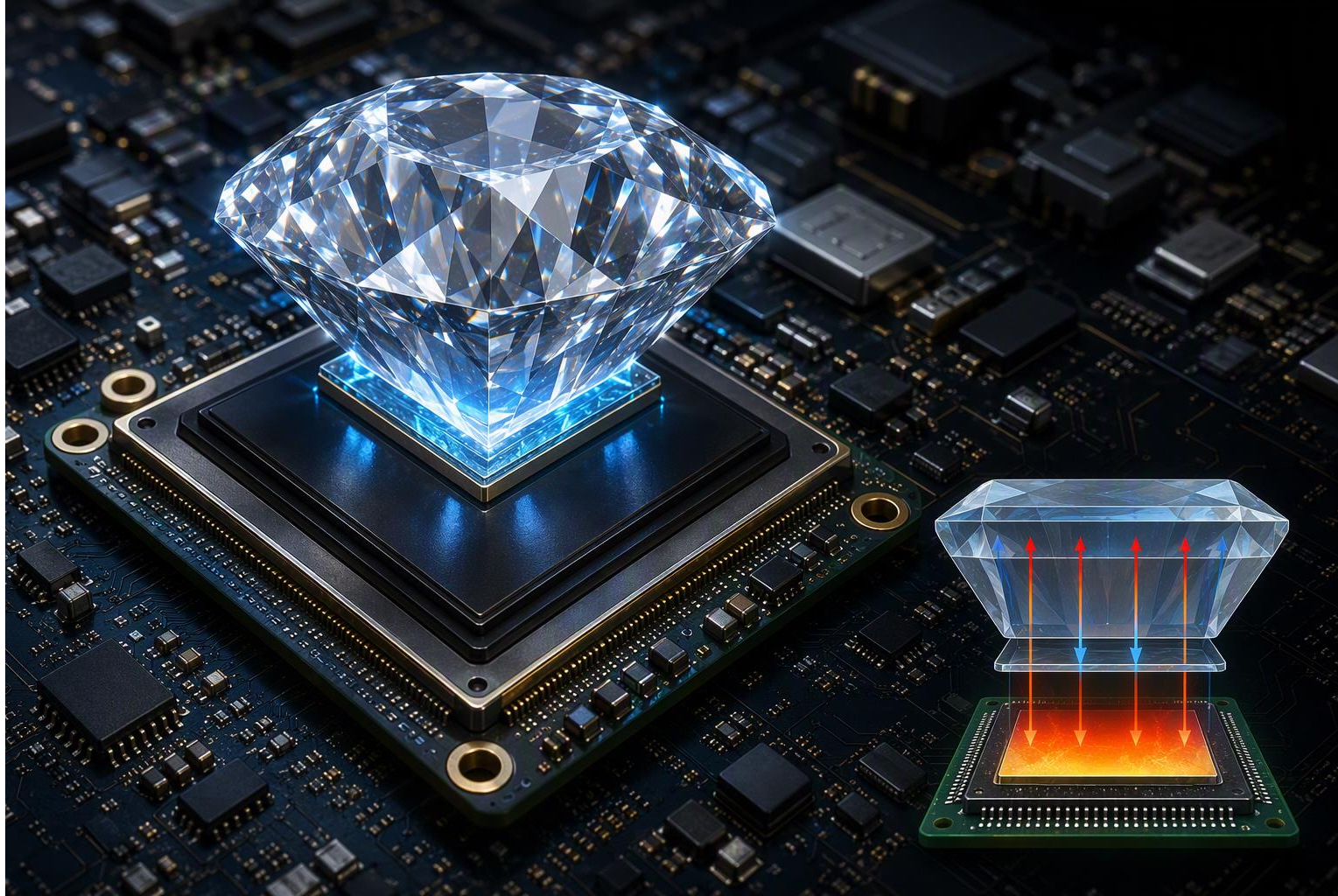
Shaping semiconductor driver IC development (EV & aero markets)



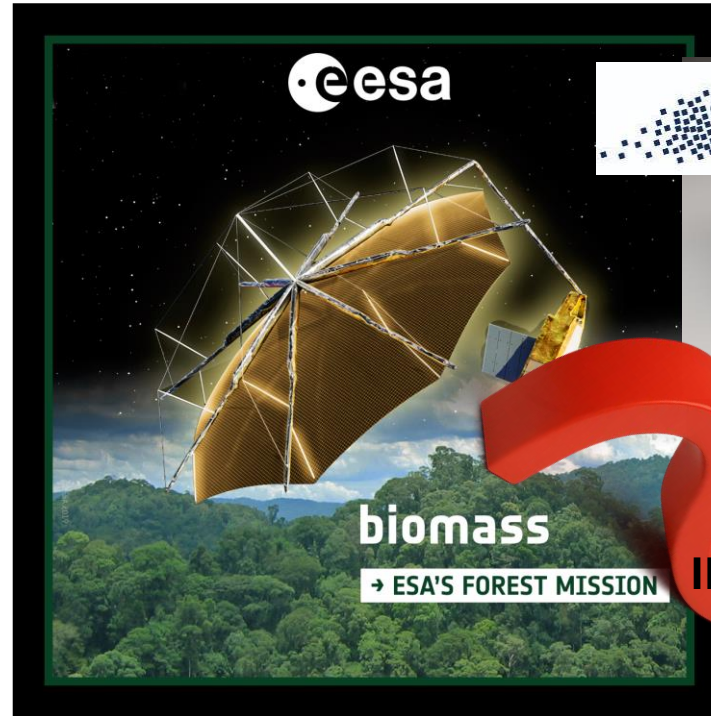
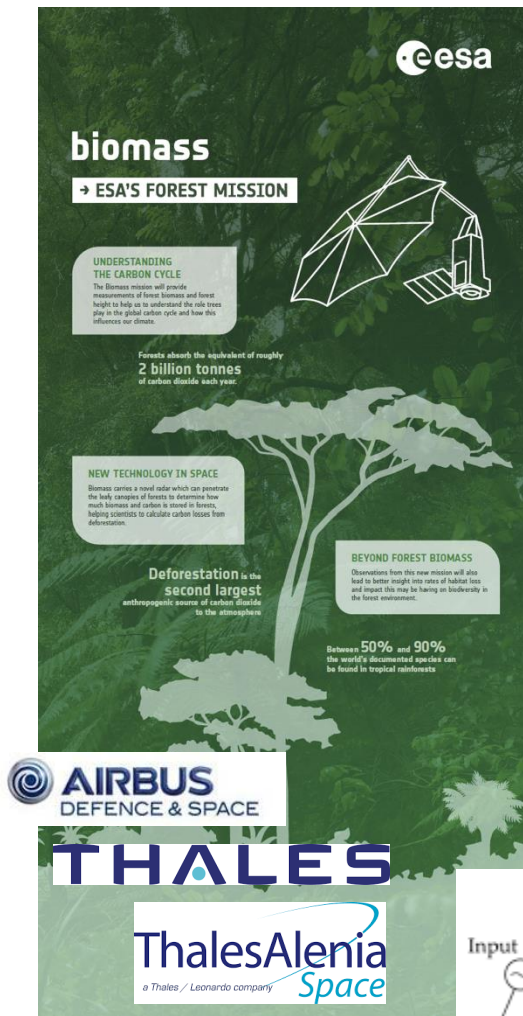
Independent validation



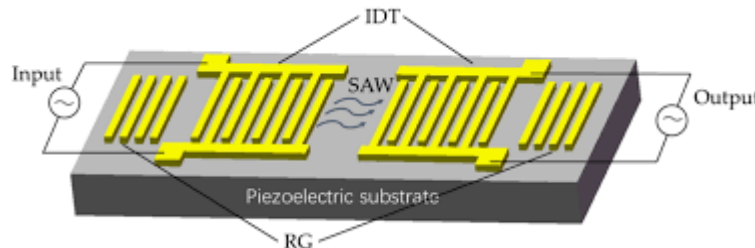
Beyond power electronics: Diamond & AI chips



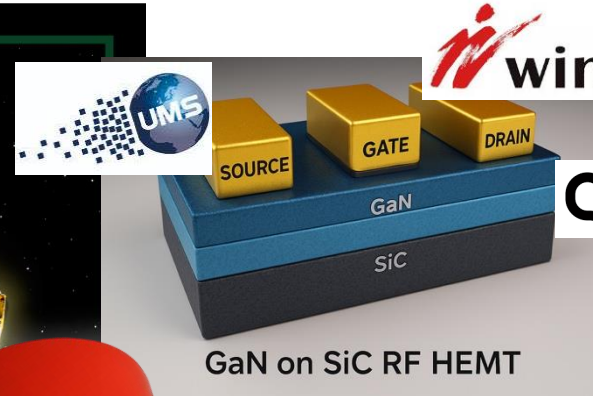
GaN RF next generation technology at Bristol



University of Bristol:
Qualification of **GaN RF HEMTs**

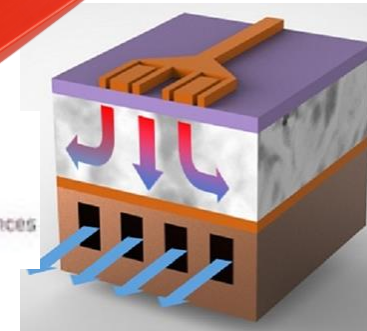


SAW on diamond substrates



Thermal & reliability testing

IP / EPSRC GaN-GaME



Commercialization GaN-on-DIAMOND electronics
for high power RF (8M Euro THRUST programme)



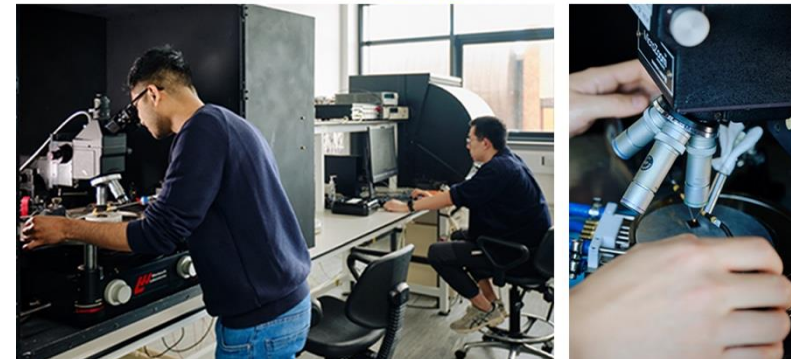
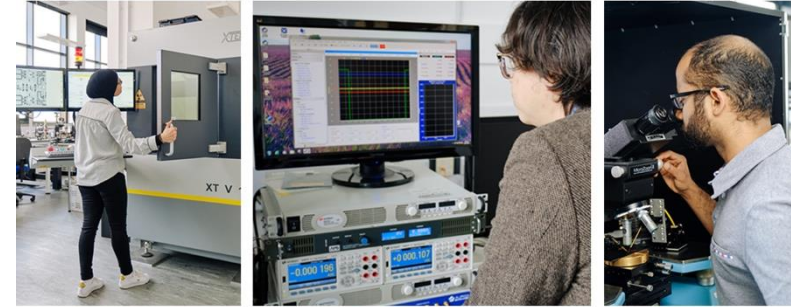
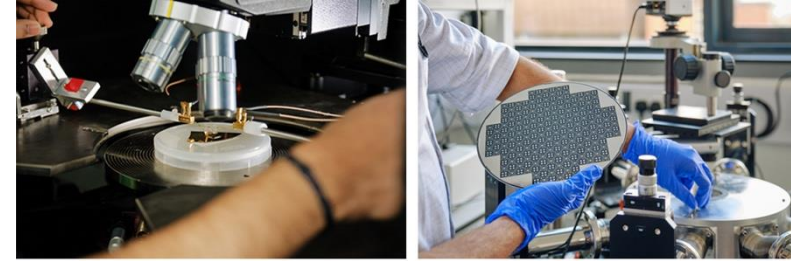
High linearity
high power
multichannel
GaN RF
technology:
Design and testing



\$24M THREADS programme



Thanks for my team



Conclusions

- There is a **huge opportunity for next generation ultrawide bandgap semiconductor technology**.
- Co-development with industry of new power semiconductor technology, example **REWIRE Innovation and Knowledge Centre (IKC)**.
- **REWIRE develops numerous technologies based on SiC, GaN, AlN, diamond and Ga_2O_3** ; these activities including commercialization e.g. SiC materials/devices, growth/devices of Ga_2O_3 on Si (and SiC) substrates.
- **Application beyond power, e.g. RF for comms and defense**, are also being driven by Bristol, eg. ESA, DARPA.
- **Opportunities of co-development between industry and academia, nationally but also internationally e.g. Japan, Taiwan, South Korea, Malaysia, Europe and US.**



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