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and Photonics

Personnel Training and Exchange

Personnel Training and Exchanges
Three pillars for a sucessful cooperation

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1st pillar

Exchange of scientific staff

Stays at universities

Stays at Research Institutes

Stays in industry for commercialization experts and future managers

2nd pillar

Joint research groups

Composed of scientist from both countries

Working on one project

Fostering the relationships between market and research

Personnel Training and Exchanges
Three pillars for a sucessful cooperation

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3rd pillar

Joint product development projects

Interest of industry either in TW or in PL

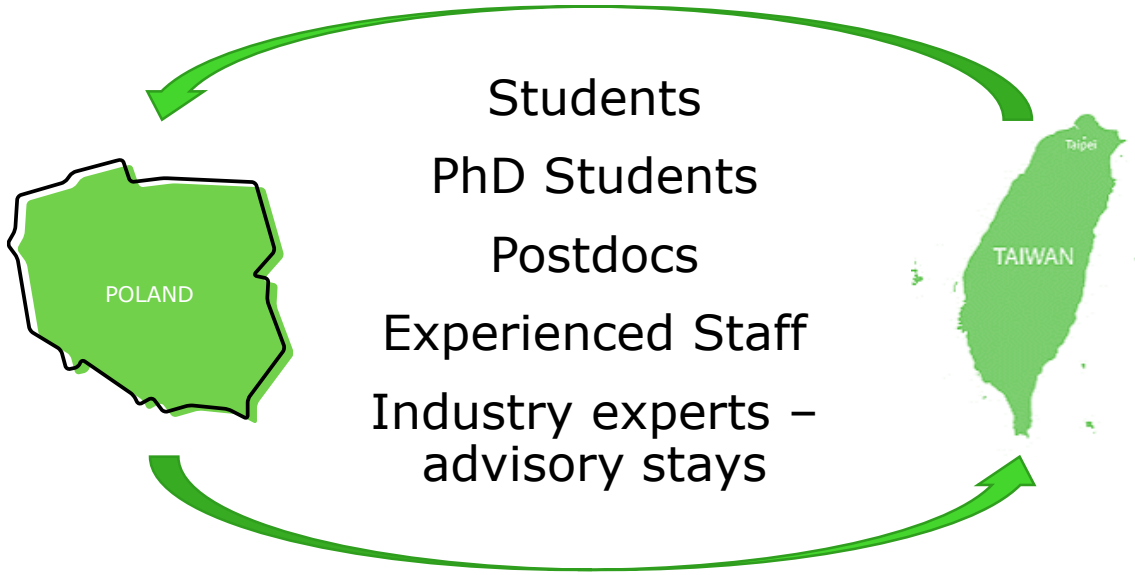
Tailor-made to the needs and trends

Towards fast and efficient product development

Current opportunities

Head of Center for Silicon Microelectronics

Change in the institute structure



Students

PhD Students

Postdocs

Experienced Staff

Industry experts – advisory stays

Towards establishing of the PL-TW Semiconductor Excellence Center

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Infant Technologies/Future Materials

Semiconductor Devices on novel substrates
More efficent devices or cost-effective processes

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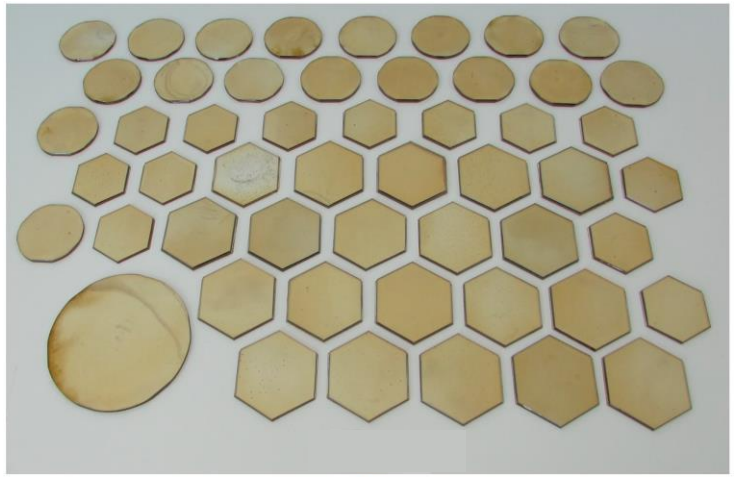
Substrates for microelectronics
- bulk GaN (vertical transistors),
- Ga2O3,
- h-BN,
- single crystal diamond,

- engineered substrates:
  - adapted to particular applications
  - lower production costs, while maintaining properties



Substrates for photonics:
GaSb, InSb, bulk AlN

Cooperation regarding establishing the requirements and needs for novel engineered substrates

Semiconductor Devices on novel substrates

for photonics, power electronics and sensing applications

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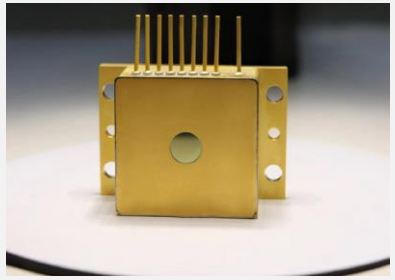
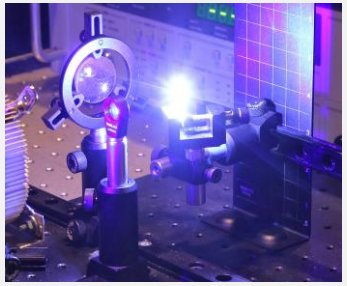
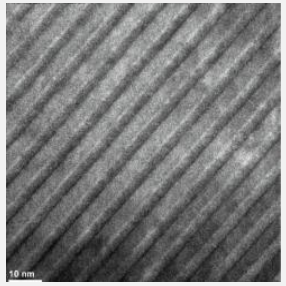
We would like to jointly develop/advance the **semiconductor technologies using Ga_2O_3, AlN, $A_{III}B_V$, diamond h-BN and other 2D materials or engineered substrates towards next generation semiconductor devices**. This would mainly consider joint R&D actions - R&D projects, conferences, workshops and commercialization, when necessary.

Antimonides (GaSb,InSb, alloys)
Arsenides (GaAs, InAs, alloys)
Phosphides (InP)

for IR and THz Quantum Cascade Lasers, VCSELs and photodetectors

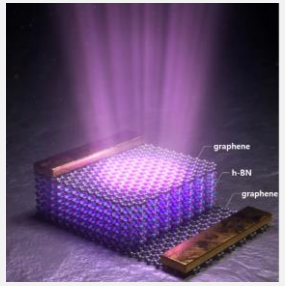


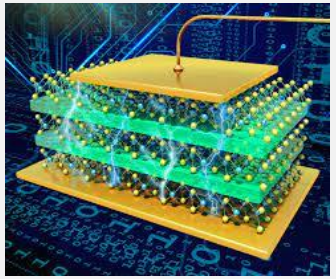


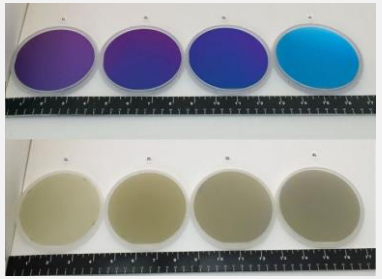


h-BN and other 2D materials (MoS_2, WS_2, HfS_2, $HfSe_2$...)

for sensors, photodetectors, transistors with possible integration with other materials







Semiconductor Devices on novel substrates

for photonics, power electronics and sensing applications

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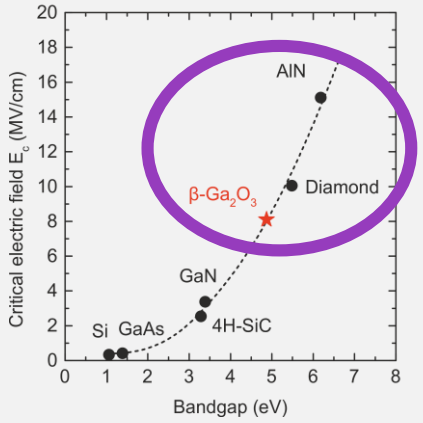
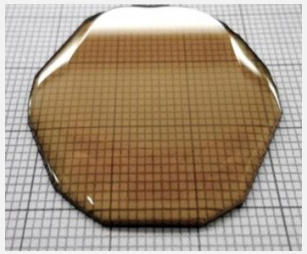
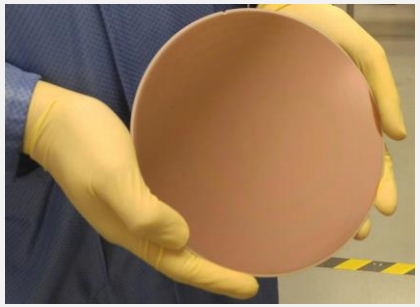
We would like to jointly develop/advance the **semiconductor technologies using Ga_2O_3, AlN, $A_{III}B_V$, diamond h-BN and other 2D materials or engineered substrates towards next generation semiconductor devices**. This would mainly consider joint R&D actions - R&D projects, conferences, workshops and commercialization, when necessary.

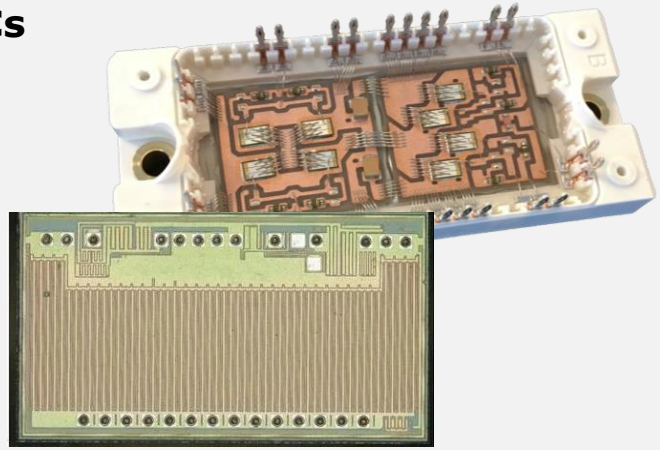
AlN, diamond, Ga_2O_3 substrates and epitaxial layers for very high voltage power electronics devices



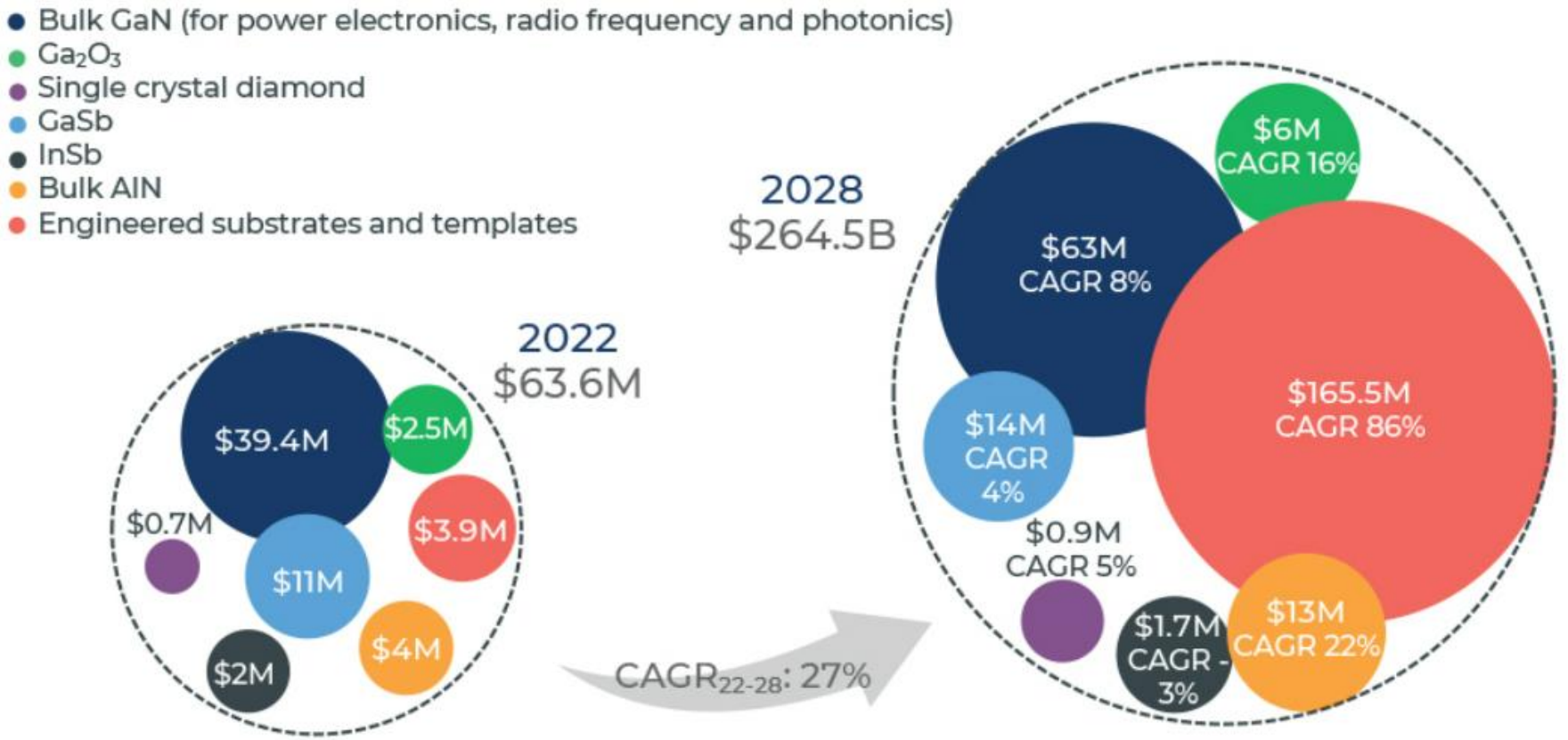


engineered substrates (GaN-on-SOI, GaN-on-QST, SmartSiC™ from Soitec, SiCkrest from SICOXS) for next generation cheap GaN and SiC power devices and power ICs





Semiconductor Devices on novel substrates
Development of wafer market



Dynamically growing wafer market demonstrates high interest in devices based on mentioned substrates, particularly in devices created on engineered substrates

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Semiconductor Integrated Circuits

Semiconductor Intergated Circuits

ASIC Development and Electronic Systems Design Lab

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The uniquely skilled Team of Professionals in Poland acting in the national research institute administrative structure of Lukasiewicz Research Network taking up challenges in the following areas:

- Telemedicine, smart control, cybersecurity
- Data acquisition systems, sensors, ROIC
- Specialized integrated electronics (ASIC, FPGA)
- Embedded software
- Automated measurements setup design
- Development of electronic systems based on commercial components
- Commercial projects for RTO / SME

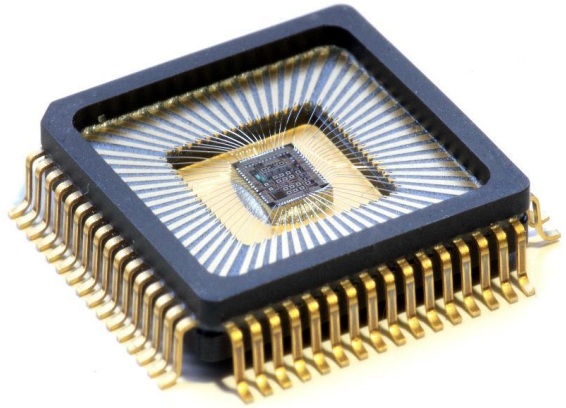
e-CUBES	FP6	2006-2010	BioSiP	PBS	2012-2015
SE2A	ENIAC	2007-2010	Nanoheat	FP7	2012-2016
MNS-DIAG	POIG	2007-2013	HeC	ROB	2013-2016
Corona	FP7	2008-2012	SESBE	FP7	2013-2017
e-BRAINS	FP7	2009-2013	CarrICool	FP7	2014-2017
MINTE	POIG	2009-2013	Lab4MEMS-II	ENIAC	2014-2018
PARSIMO	ENIAC	2011-2014	APRIL	POLBER2	2015-2017
SMAC	FP7	2011-2015	ParCour	POLBER3	2018-2020

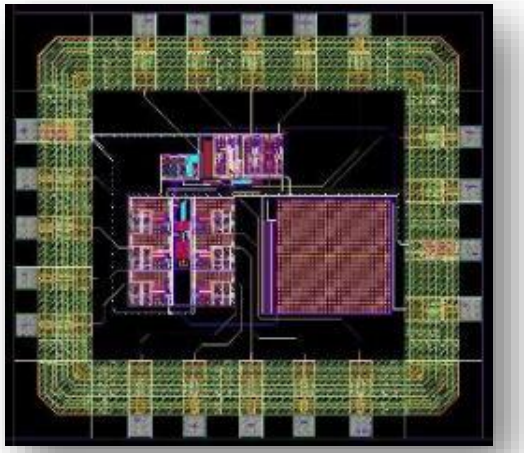
R3-PowerUP	H2020	2018-2022	300mm Pilot Line for Smart Power and Power Discretes
REACTION	H2020	2018-2022	first and euRopEAn siC eigTh Inches pilOt line
CHARM	H2020	2020-2023	Challenging environments tolerant Smart systems for IoT
Milevianse	POLBER4	2020-2022	MIcroLens WIde ANgle Sensor and AI
DIH-World	H2020	2020-2023	Accelerating deployment and matureness of DIHs for the benefit of Digitisation of European SMEs
MirPIC	TMS3	2021-2024	Technologie układów fotoniki scalonej na zakres średniej podczerwieni

Semiconductor Intergated Circuits

Activities related to IT/OT and Cybersecurity

- Hardware implementation of encryption systems
  - ASIC, FPGA
- Development of integrated IoT appliances
  - Microcontroller – based SoC – electronic system in a single chip
    - Configurable architecture
    - Variety of interface modules available
    - Configurable instruction set, non-compatible with commercial MCUs
    - Integration of RAM and non-volatile memories
      - System booting from encrypted program memory
    - Integration of tailored analog peripherals
    - Embedded cryptosystem accelerators





Semiconductor Intergated Circuits

Current needs related to IC Design

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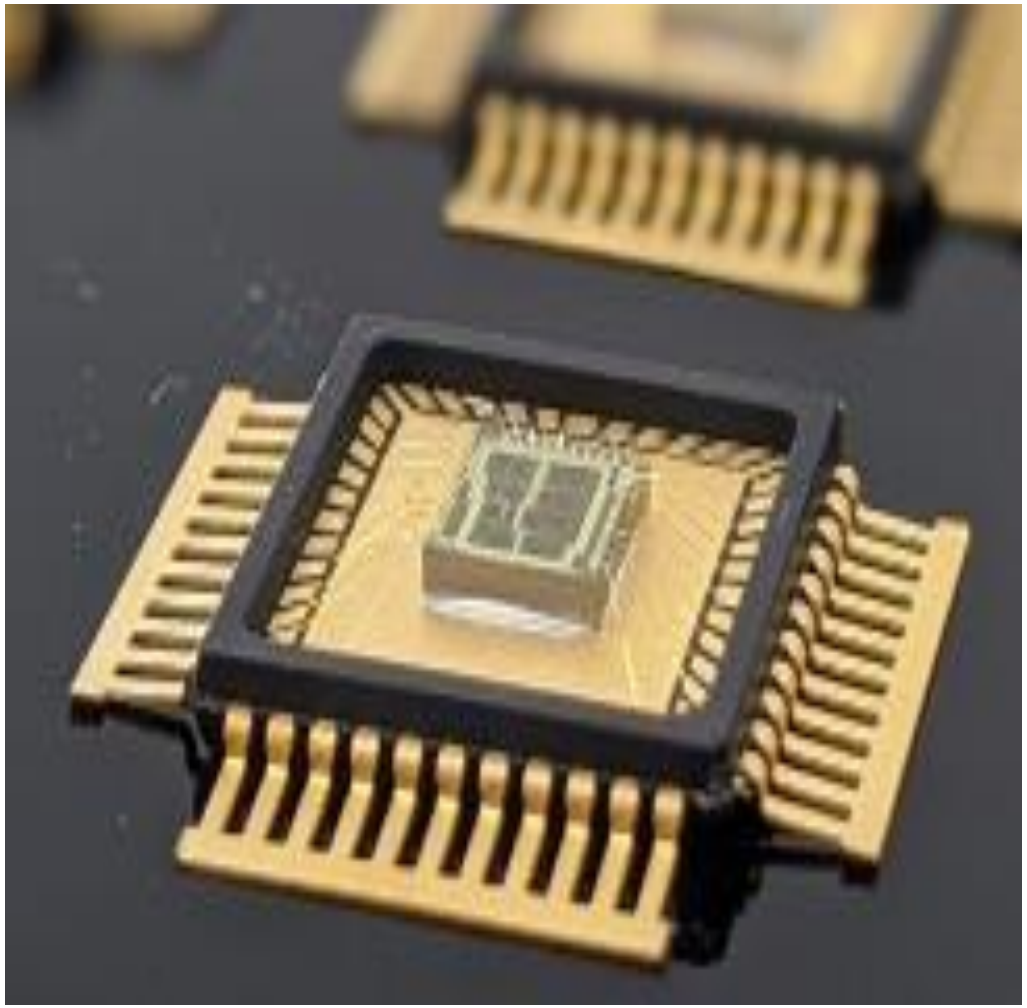
- Access to design libraries
- Acesss to fab facilities for small volume test production of transistors and integrated circuits
- Access to professional industrial design software
- Access to Production Design Kits under balanced NDA



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Infrared Photonics

Infrared Photonics

for wireless optical communication, sensing, IR countermeasures

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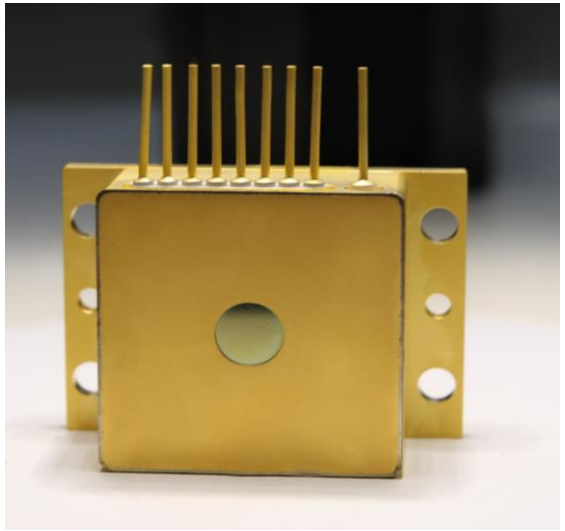
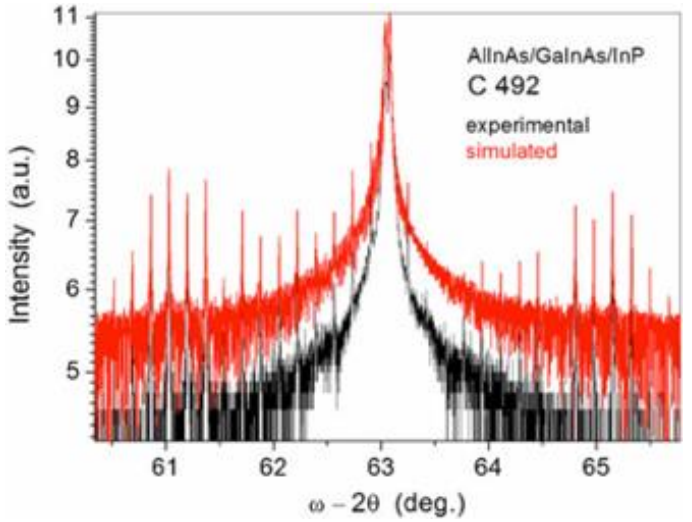
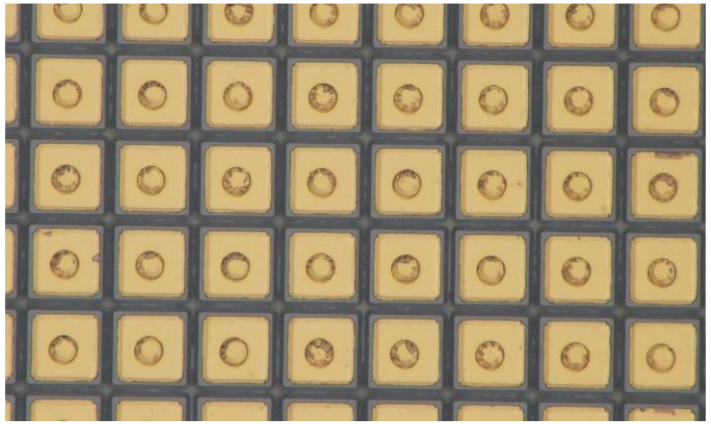
Technology of mid-IR QCLs





Sb-based type II SL detectors



Infrared Photonics

for wireless optical communication, sensing, IR countermeasures

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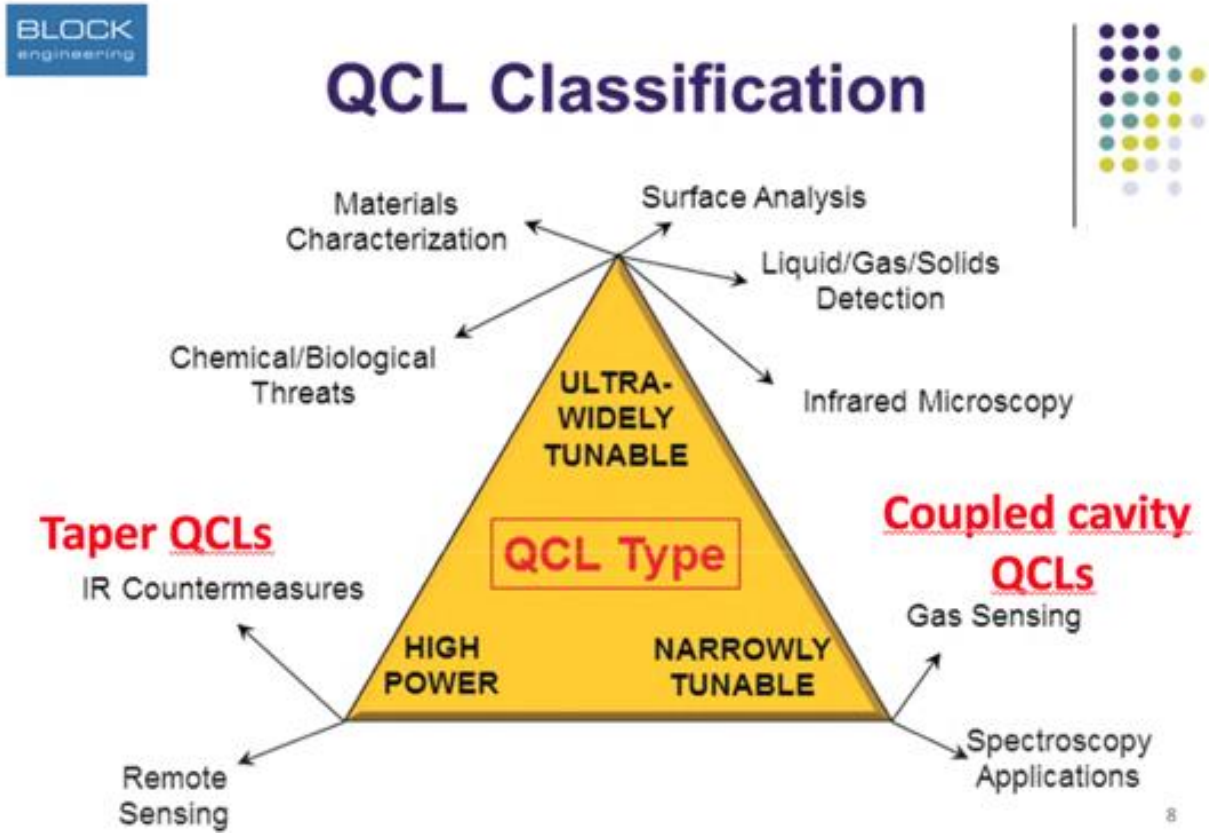
We develop mid-IR QCLs since 2009.

Current wavelength range:

4.5-5.5 μm and 8-10+ μm

Current designs:

- **Single mode: CC – QCLs, DFB**
- **High power devices: Taper QCLs**



Infrared Photonics

for wireless optical communication, sensing, IR countermeasures

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Interest in cooperation – R&D and industry:

Increase of know-how and technology level

Exchange of ideas and expanding collaboration with leading TW groups

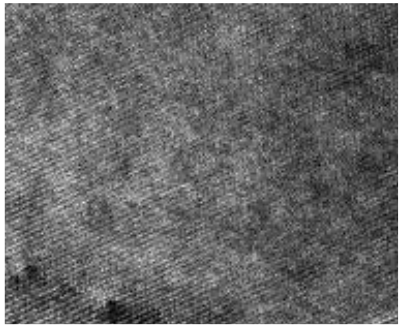
Topics for cooperation:

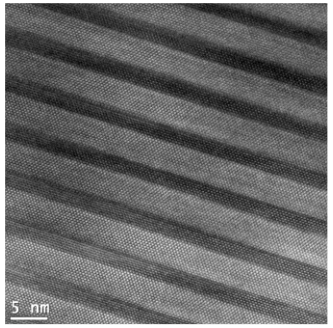
- Mid-IR devices and applications,
- fabrication, growth of semicon structures,
- development of application specific light sources,
- lasers for sensing

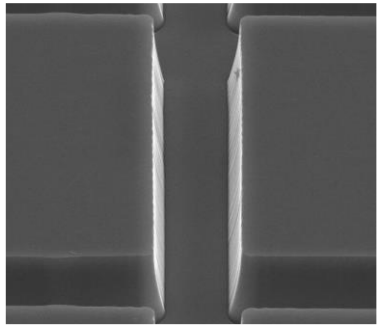
R&D Experience:

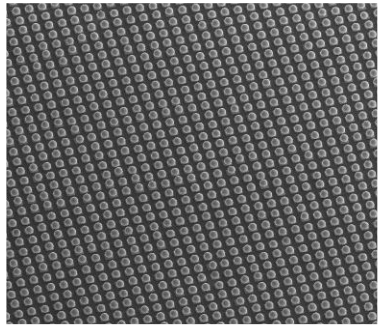
many projects focused on development of devices:

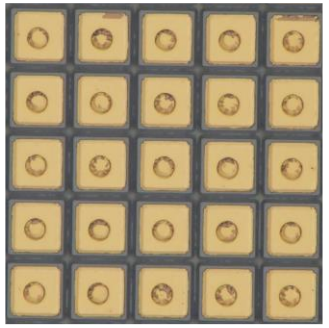
- Development of single mode QCLs for application in gas sensing systems
- Development of high power QCL (modules/heads)
- Development of QCL modules for mid-IR operating FSO system
- Development of MWIR heterostructures (growth and fabrication technology) and FPA processing











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