Centre for Advanced Materials and Technologies CEZAMAT

WARSAW UNIVERSITY OF TECHNOLOGY

Warsaw University of Technology

WUT

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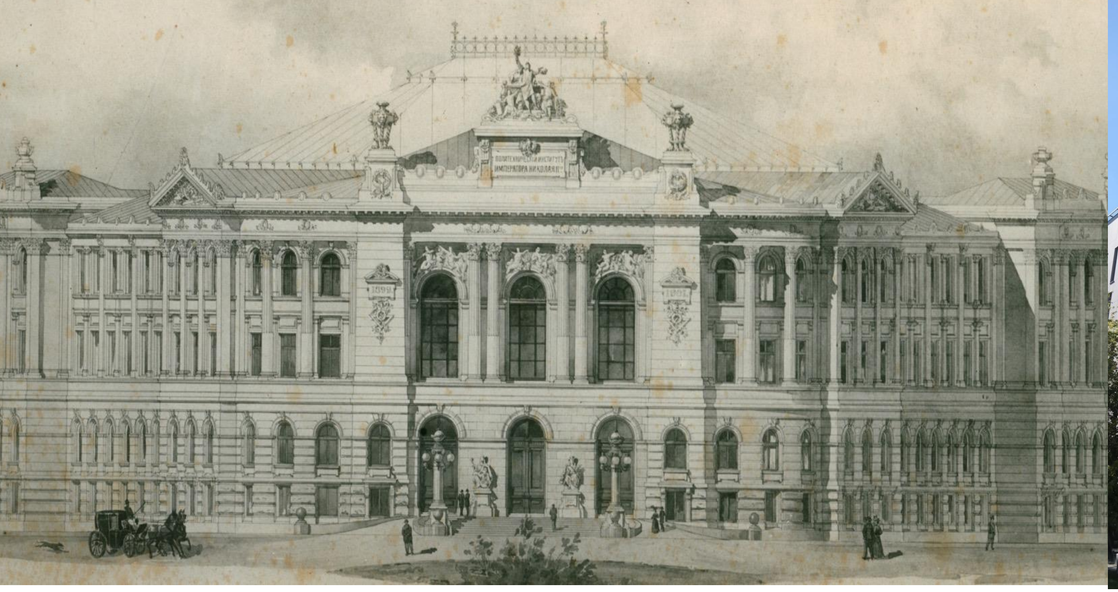
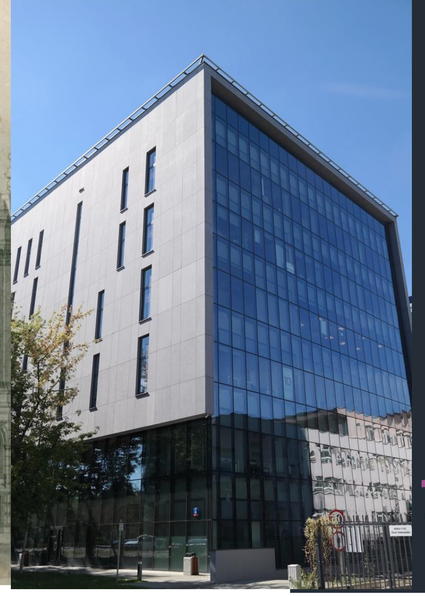
CEZAMAT connecting R&D infrastructure with the regional and (inter)national ecosystems of innovation

Warsaw University of Technology





79 → fields of study

19 × faculties
+ 1 COLLEGE

26 276 ∑ students

587 = professors

1 000 000 ≤ volumes
IN THE LIBRARY OF WUT

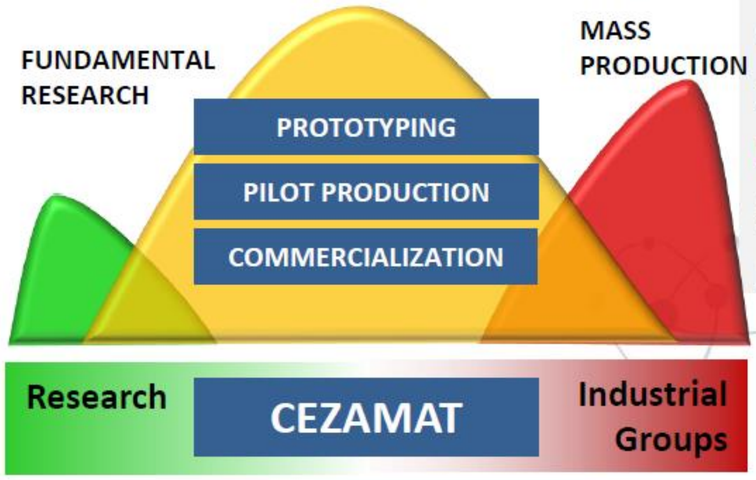
The Warsaw University of Technology began its independent activity on November 15, 1915. Its history, however, is much longer and goes back to 1826. The University has since educated many successive generations of engineers, thereby making a significant contribution to the advancement of science and technology both in Poland and around the world.

In 2019 Warsaw University of Technology joined the prestigious circle of universities qualifying for the program initiated by the Ministry of Science and Higher Education "Excellence Initiative – Research University", thus entering a new development stage. Now WUT is striving to gain the status of a recognised European research centre with its significant impact on global science.

RESEARCH UNIVERSITY
EXCELLENCE INITIATIVE
Ministry of Science and Higher Education

Centre for Advanced Materials and Technologies – CEZAMAT

Investment	>100 mln EUR
Offices	5.500 m²
Laboratories	19.800 m²
Clean-rooms	4.000 m²
Conference center	~ 650 people
Personnel	~ 250 people



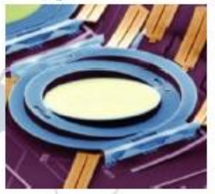
Custom design

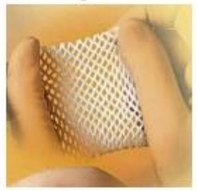
Idustry-match pilot production

Fully secured conditions – IP control

Stat-of-the-art nanoelectronics

Developed local partners ecosystem





TRL 4 - 9

- Simulation & Design
- Prototyping
- Pilot production
- Characterization
- System integration

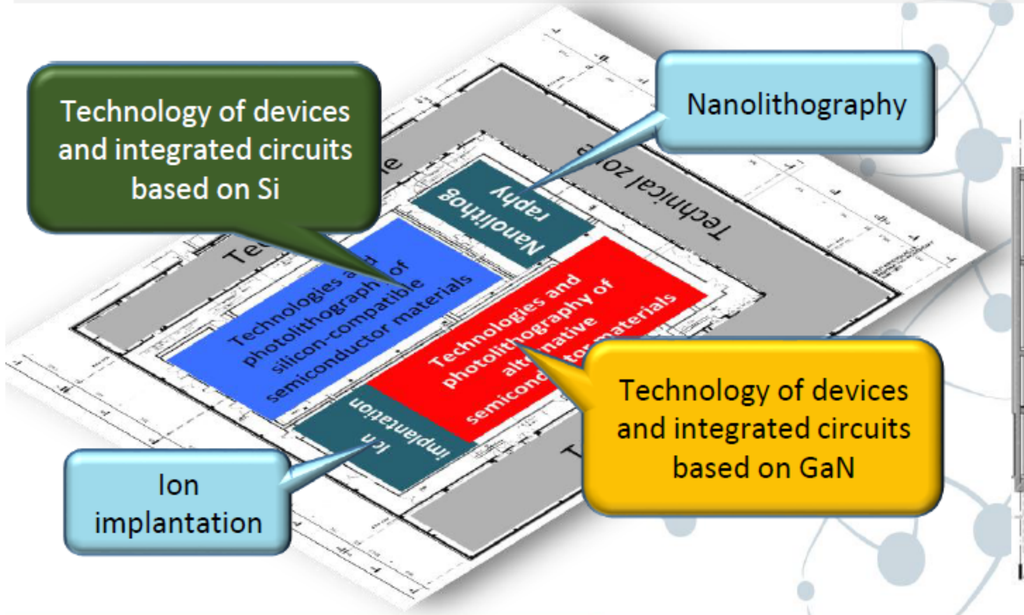
CEZAMAT – Central Laboratory

Interdisciplinary Research Platforms

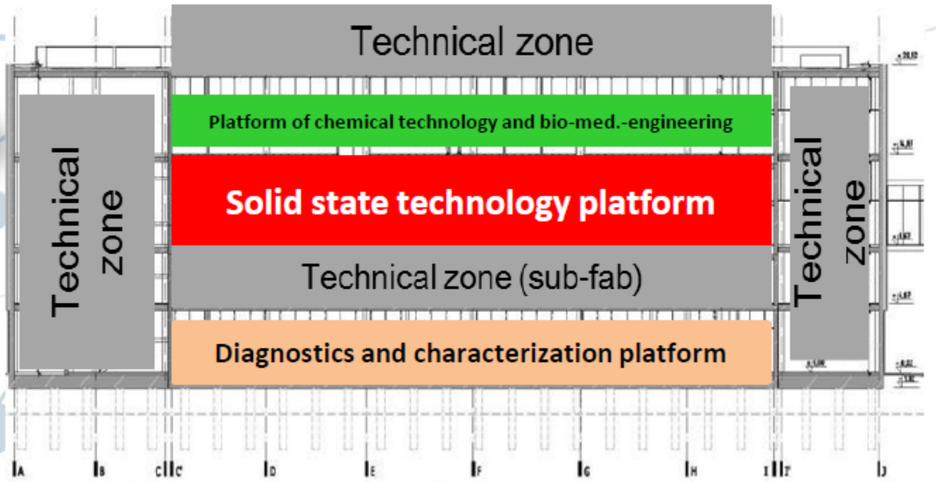
- Modelling and simulation platform
- Platform of the technology of structures, devices and circuits
- Platform for development of new materials
- Platform for diagnostics and characteristics of materials, structures, devices and circuits
- Bio-engineering Platform
- Printed Electronics Platform

Organization of research work and space at the Central Laboratory is conducive to carrying out interdisciplinary research and provides high flexibility as regards the topics of work in:

- Nanotechnology
- Micro- and nano-electronics
- Micro- and nano-photonics
- Microsystems (MEMS/MOEMS)
- Nanomaterials and functional materials
- Bio-med-chem engineering
- Space technology



Technology Building



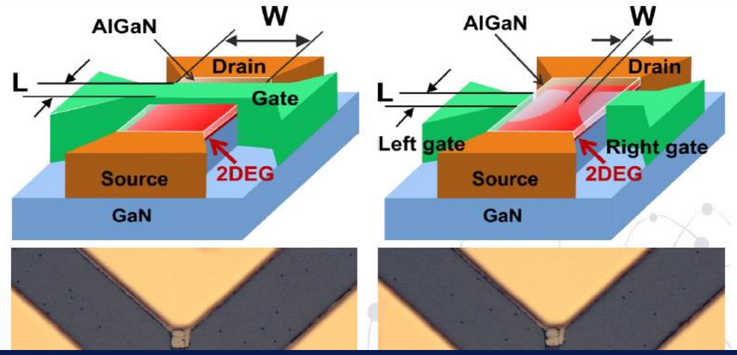
Terahertz Technologies – CENTERA in cooperation with UNIPRESS

Centre for Research and applications of Terahertz Technologies CENTERA:

- < 10M EUR investment (Foundation for Polish Science)
- Based on Institute of High Pressure Physics PAS and CEZAMAT staff and infrastructure
- European Partners:
  - Goethe Universitaet – Frankfurt (Germany)
  - CNRS – Lille (France)
- Founders: Prof. Wojciech Knap, Prof. Thomas Skotnicki
- Already over 30 specialists and leaders (still recruiting)

GaN/AlGaN transistors with lateral gates as THz devices

P. Sai, et al., Semiconductor Science and Technology 34 (2019) 024002

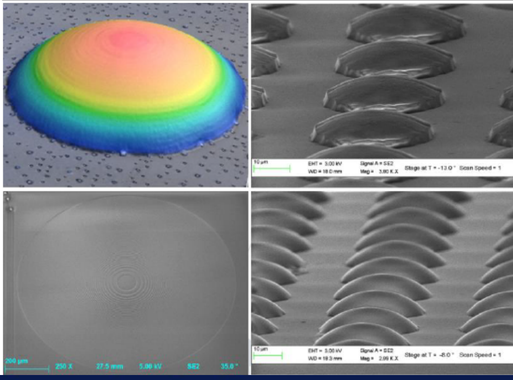


Passive optical elements – microlenses

Manufacturing:

- Drawing up the method of the production:
- A curve of the contrast was experimentally outlined (grayscale)
- Processes were drawn up repeated spinning of PMMA layers in for achieving the thickness to 10 µm
- A process was drawn up for reliquidization of surface of lenses after manufacturing (reflow) in the objective of lowering of the coarseness
- Different types of microlenses were manufactured with diameters from a dozen or so micrometers to single millimetres and the height of a few micrometers
- Also making aspherical microlenses is possible

Microlenses manufactured in PMMA

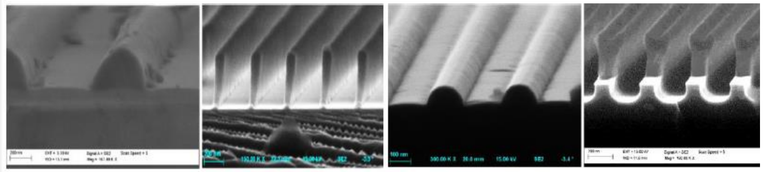


Passive optical elements – diffractive structures and grayscale

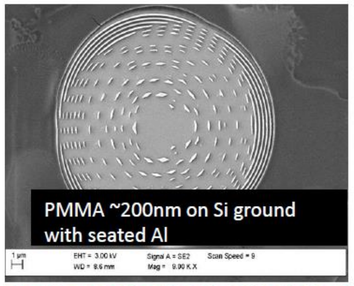
Preparation of the processes of production of diffraction components:

- The required PMMA layer preparation process has been developed
- Designs of less than 1µm were made
- Digestion optimization is underway to move patterns to the SiO2 layer

Diffraction elements (Si, SiO2 dry etch)

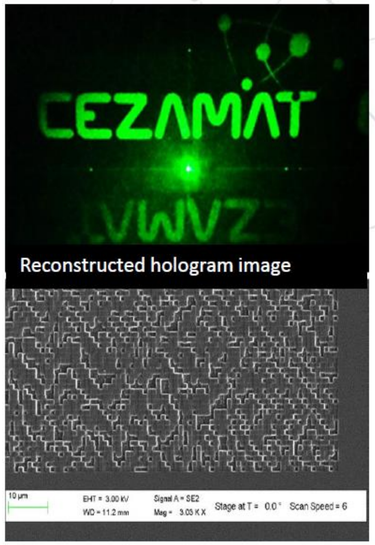


Holograms and grayscale lithography



Applications:

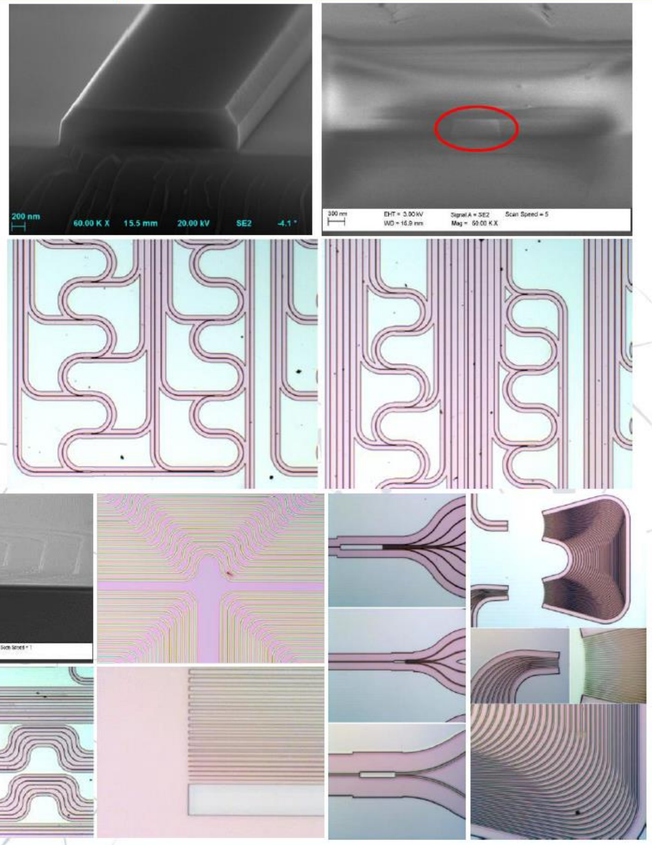
- Production of reflecting and transmission holograms with sub-micron pixel sizes
- 256 degrees of phase modulation
- Good separation of diffraction rows
- Based on PMMA on flat ground and made using electronolythographic techniques
- Pattern based on client-supplied graphic file



Passive optical elements – Si_xN_y photonic platform

Manufacturing:

- 4-inch silicon wafers (100)
- Processing:
  - Cleaning
  - Oxidation (1200 °C) – **2.3 µm SiO_2 layer**
  - Low Pressure Chemical Vapor Deposition (LPCVD) – **0.32 µm Si_3N_4 layer**
  - E-beam lithography with a positive resist - patterning
  - Development and dry reactive ion etching (RIE)
  - Plasma Enhanced Chemical Vapor Deposition (PECVD) – **2.3 µm SiO_2 layer**
- Cleaving



CEZAMAT – Partnership models

Long term strategic industrial partnership

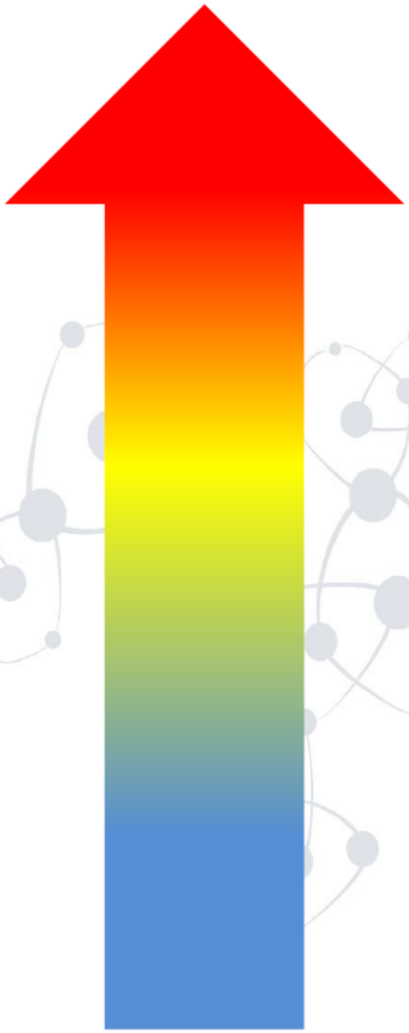
- Joint development laboratories, teams and programs
- Joint R&D centres, pilot production and integration centres
- Dedicated spin-off, spin-out companies for joint development of particular technologies

Partnership in consortiums around strategic R&D programs

- CEZAMAT as R&D backup for industrial partners in consortium
- EC founded programs and national programs
- Setting up dedicated spin-off companies for IP commercialization

Research on demand – full IP transfer to industrial partner

- Solution of specific engineering problems
- Design and pilot production of microelectronic and electro-optical components and system integration



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The research is carried out in the following areas:

- Internet of Things
- Cybersecurity on circuits level
- Split Manufacturing
- Terahertz technology
- Miniaturisation
- Modern therapies and materials for diagnostic and therapeutic purposes
- Bioengineering and artificial organs
- Drug research and development
- Energy storage and conversion

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Evidence of success (up to now):

- innovation ecosystem moderator as a Digital Innovation Hub
- living lab of creating and testing new ideas
- 34 companies have used R&D infrastructure (R&D)
- 150 completed research R&D projects
- 42 international projects R&D carried out
- 30 new research jobs created
- 55 auxiliary and technical staff employed to operate R&D
- 91 scientific entities and 312 scientists involved in CEZAMAT R&D activities
- 415 students used the CEZAMAT R&D facilities

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