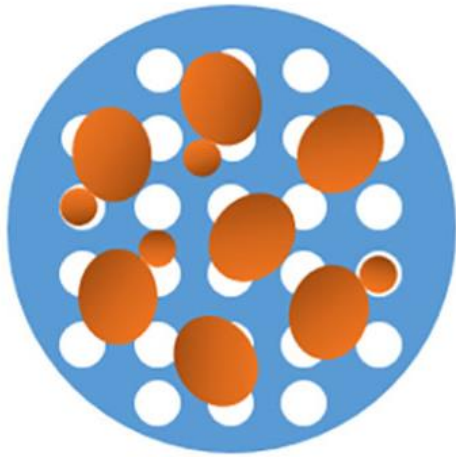


Nanoactuator for bioMEMS



Nanoactuator LLC

Disadvantages of existing methods. Competitive Advantages of Nano biosensor



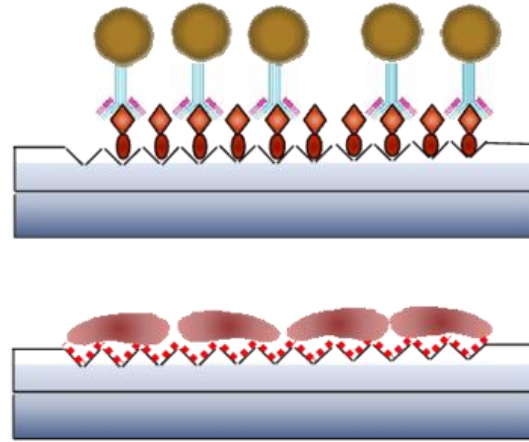
Non-electronic monitoring
with label

Require a large amount of target
biomolecules for reliable detection

Increasing diagnosis time

Increasing screening test expenses

VS



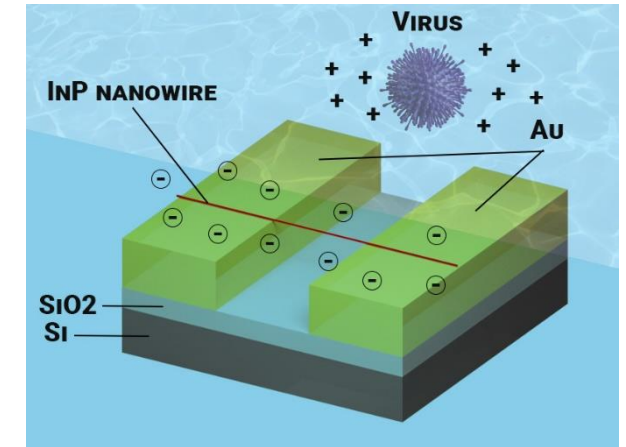
Thin film biosensors

Larger surface = less sensitivity

Real-time monitoring

Available method

VS



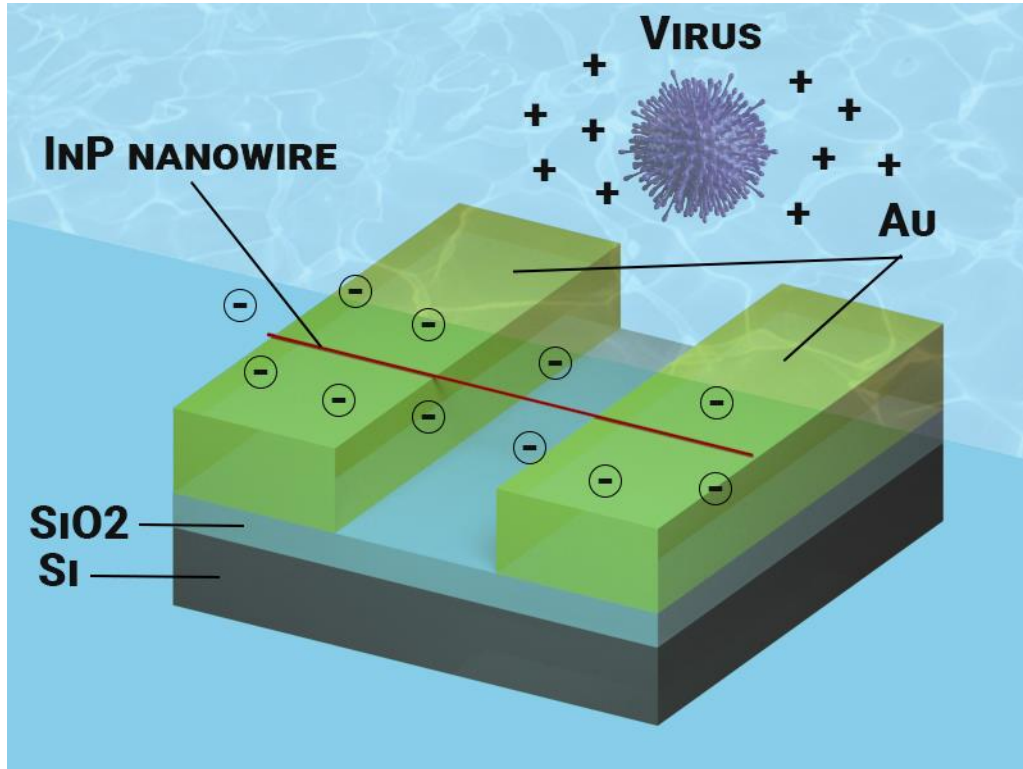
Nano biosensors based
on InP nanowires (NWs)

Smaller size = greater sensitivity

Real-time monitoring

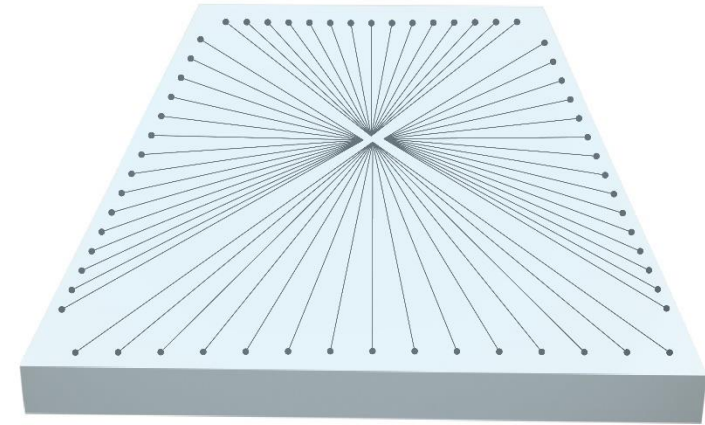
Available method

Technology for the diagnosis of infectious diseases using a nano biosensor



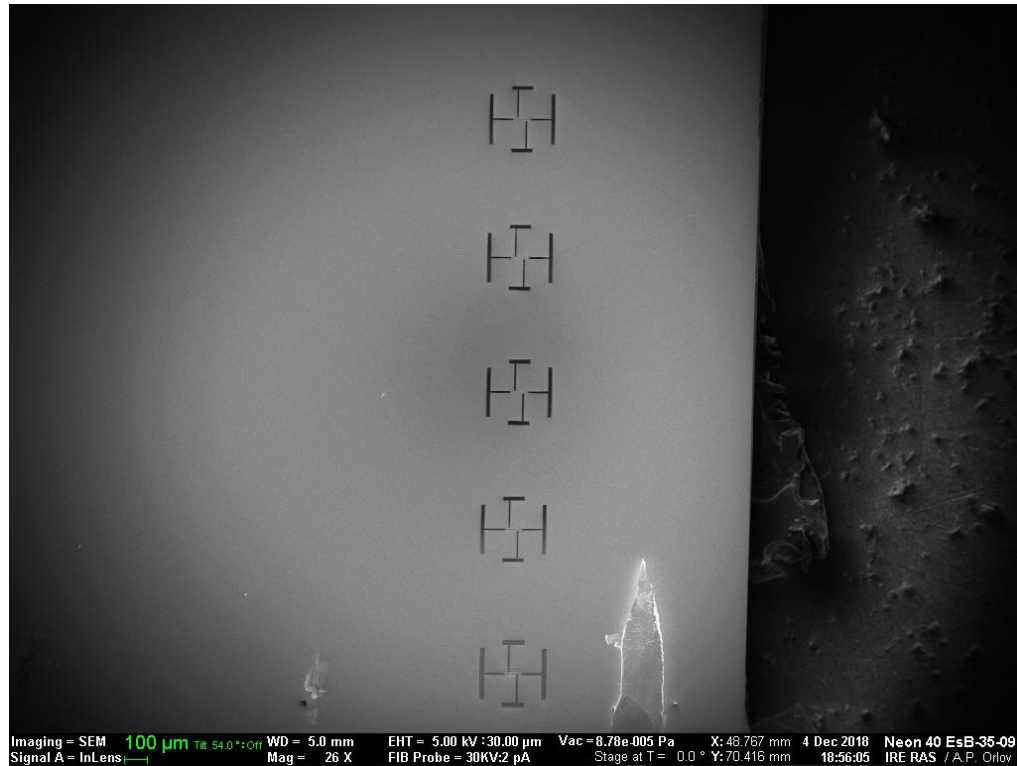
Sketch of bio-sensor device based on field-effect transistor based on InP nanowire

SENSOR CHIP

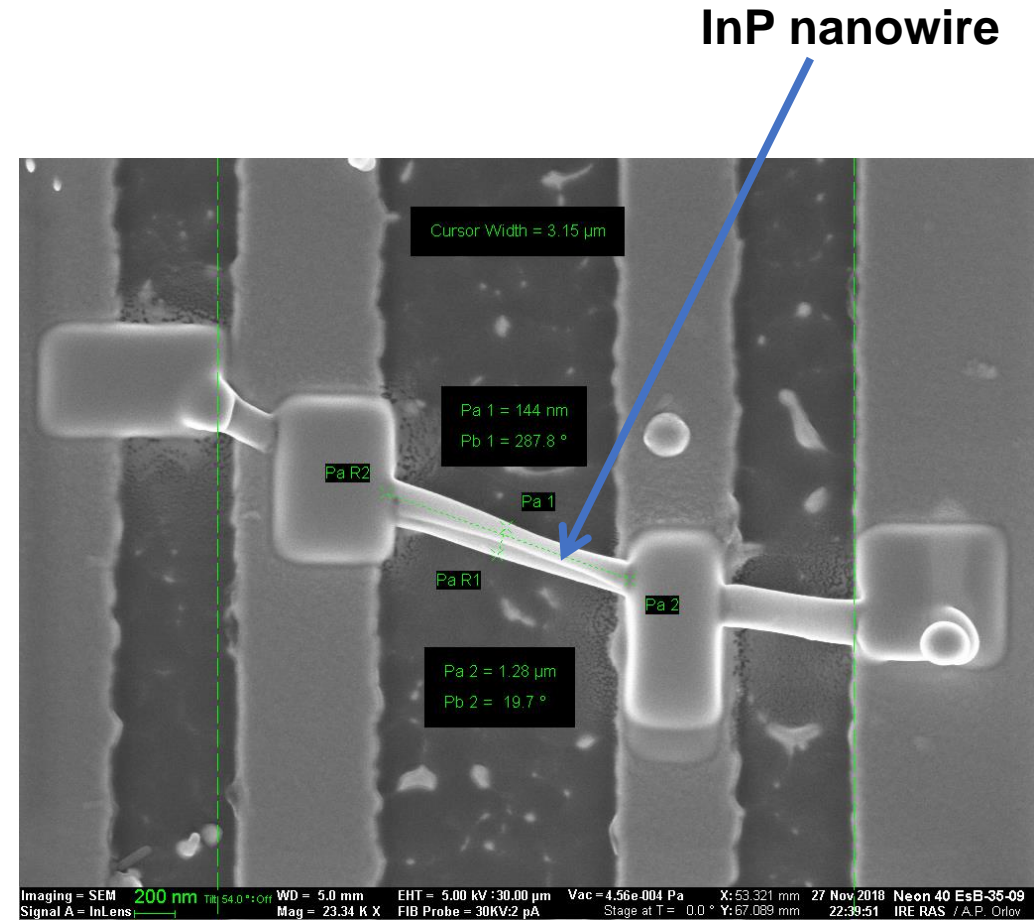


Schematic illustration of the sensor chip consisting of many bio-sensors

Biosensor structures

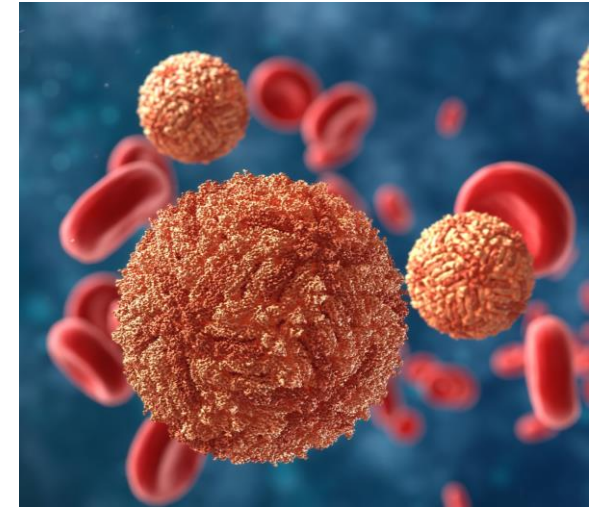
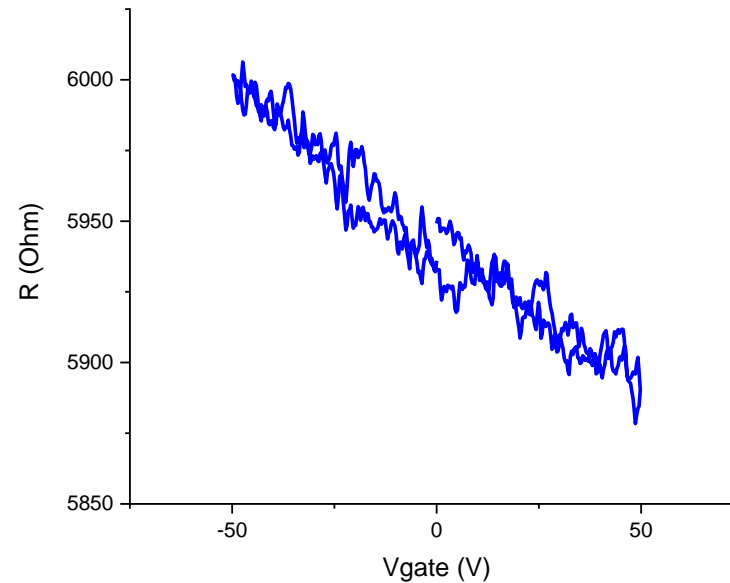
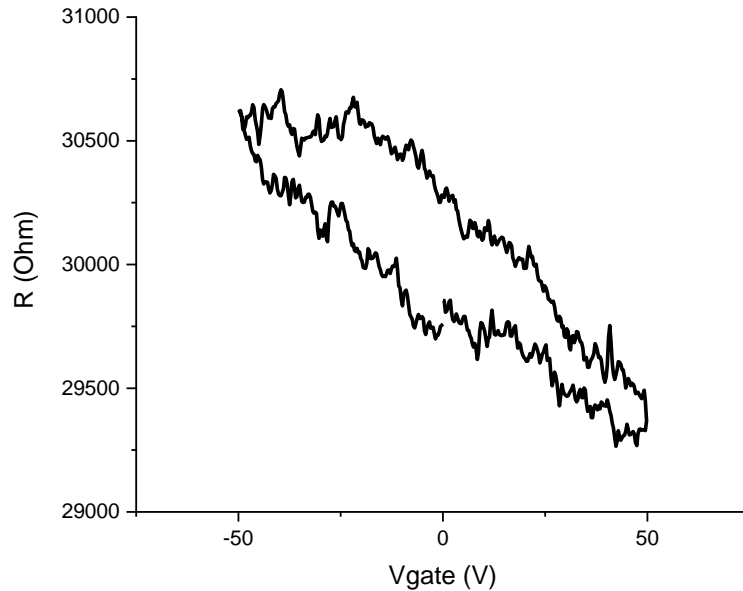


Sensor structures made by FIB



Prototype example of the InP sensor

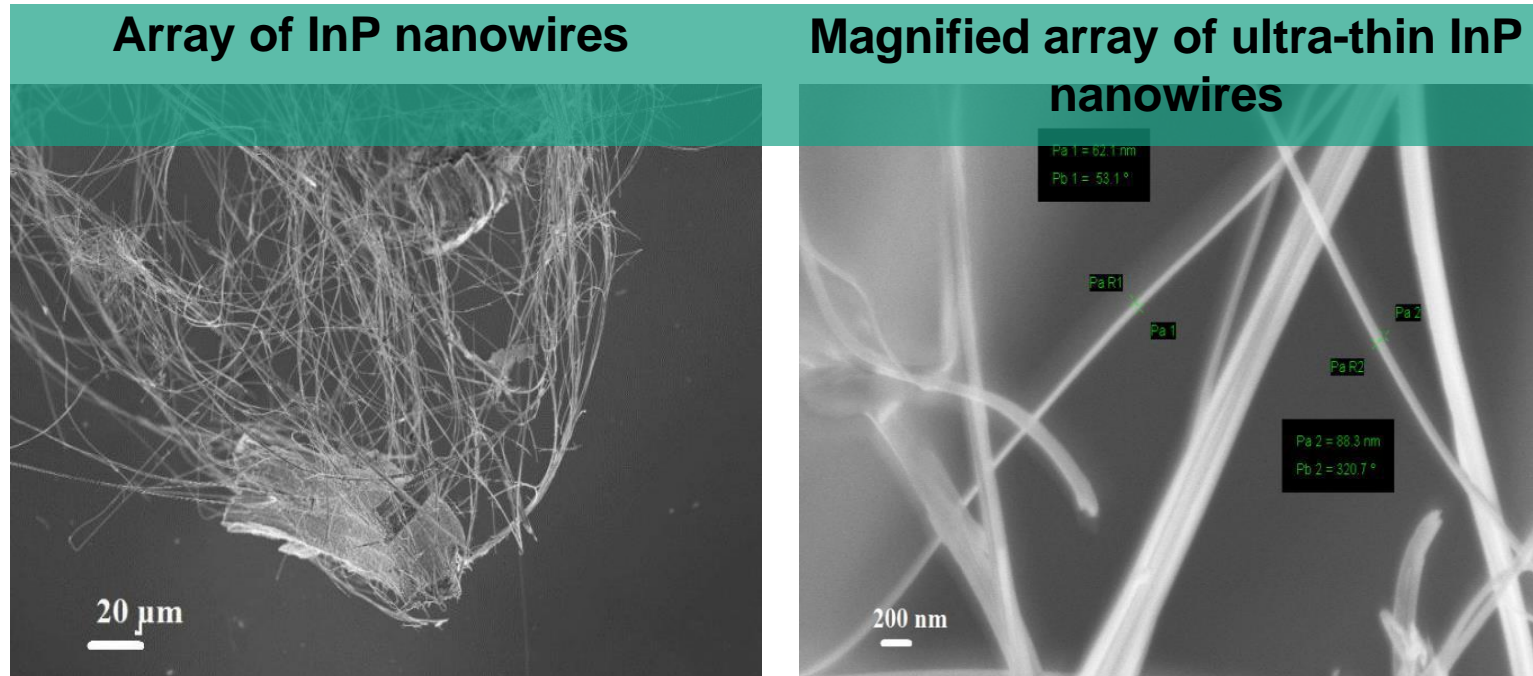
Field effect of the InP sensors



There is a decrease of the resistance of the InP nanowire at U gate changes.

It proves the possibility of making bioMEMS for the detection of various pathogens such as Zika virus.

InP nanowires as a key and sensitive element of the nano biosensor

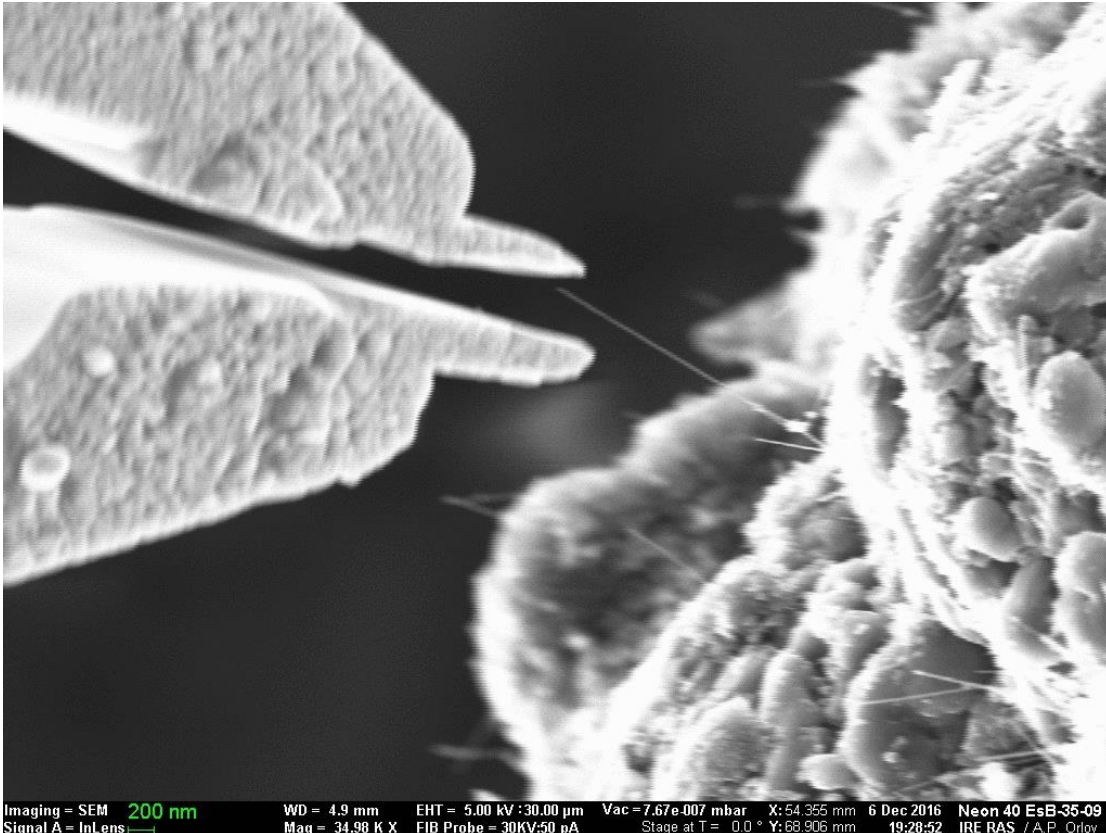


- X** InP nanowires can't grow in specify direction
- ✓** Bottom-up technology of constructing sensing devices

Shape memory effect nanoactuator (nanotweezers) - our invention



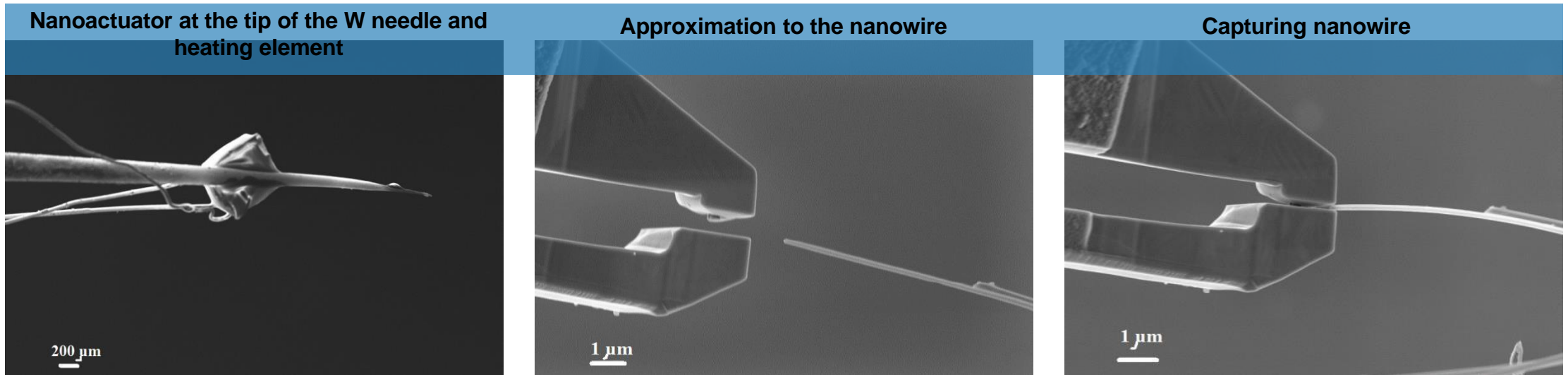
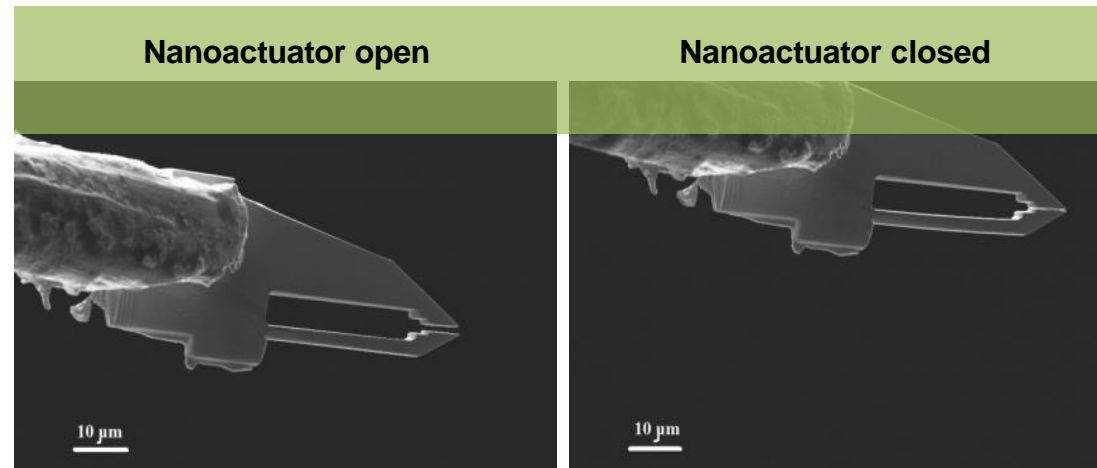
Nanoactuator - the only device capable of manipulating with InP and other nanowires



NANOACTUATOR - a miniature device for three-dimensional manipulation (capture, movement, retention and attachment to the right place) of micro- and nano-objects.

- **The nanoactuator** is mounted on commercial manipulators in the chamber of an electron or ion microscope and is triggered (closed) when heated by electric current
- **10^7 cycles withstands nanoactuator**
- **7 000 Euro is the cost of a batch of nanoactuators (5 pieces)**

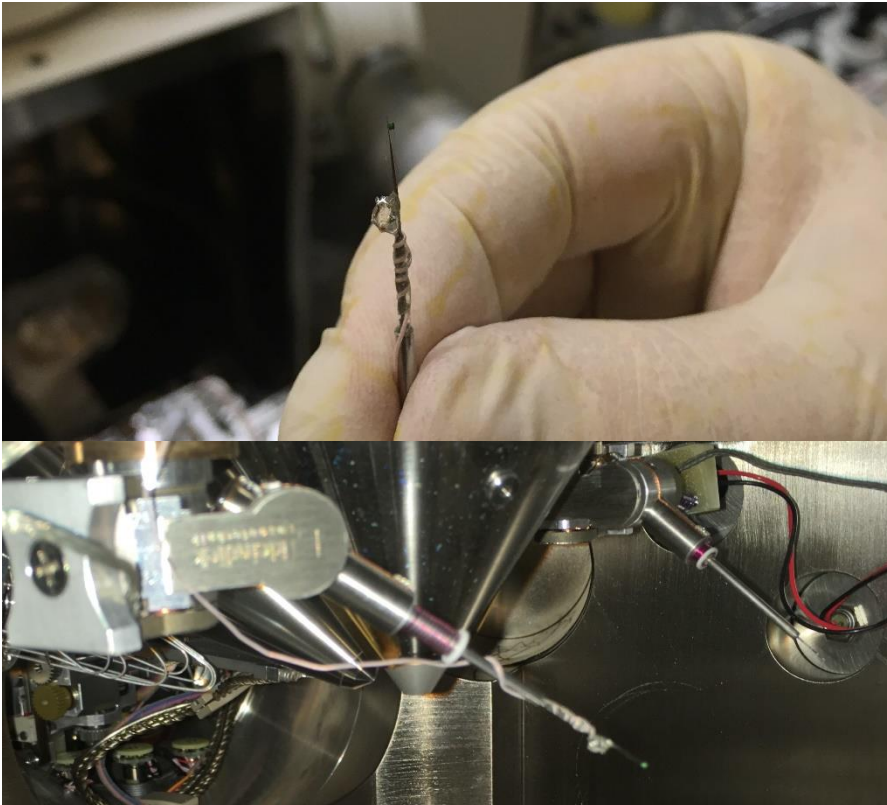
Bottom-up technology of 3D nanomanipulation



Technical characteristics of the nanoactuator

	Nanoobjects	Microbioobjects
Manipulation environment	Vacuum	Biological environment, air
Object dimensions	10 – 100 nm	1 – 5 mm
Capture sizes, min / max mm	1 / 20	5 / 200
Working temperature, °C	30 – 60	30 - 60
Positioning accuracy	1 – 10 nm	1 – 10 mm

Integration with the existing nanopositioning systems



It can be easily fixed with nano position units of microscopes

Kleindiek

Kleindiek Nanotechnik GmbH



OmniProbe

Oxford Instruments



The Business of Science®

EasyLift NanoManipulator System

Thermo Fisher Scientific (FEI)



Kammrath&Weiss

Kammrath&Weiss GmbH



Other nano positioning systems with electrical outputs

Benefits

Characteristics

Solved problem

BENEFITS

Unique consumer qualities

- The use of nano-positioning systems for manipulating nano-objects, which **are millions of times larger than nano-objects**
- **A significant increase** in the cost of production and use

Working temperature 30-60 °C

- High operating temperature destroys biological structures

Record high small sizes for nanocapture

- **Expensive** nanomodeling procedures
- Rather **expensive and complicated** process of manipulating nano-objects
- Capture of **nanoparticles by 2-3 captures of significantly** more expensive nanoposition systems

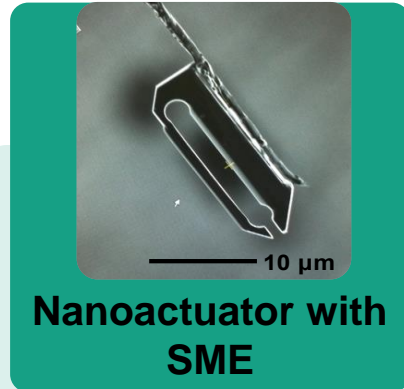
✓ The size of a nano-tool **of the same order with a manipulated nano-object**

✓ No heating required to temperatures damaging the biological structure
✓ The ability to manipulate biological microobjects

✓ **Simplification and cheapening** of the production process (for mass production)
✓ **Simple and intuitive use** process
✓ **Significant price advantages**, including the fact that one nano capture is enough to capture a nanoparticle
✓ For the first time in the world, it provides the ability to manipulate in enclosed spaces measuring several microns
✓ This makes it possible **to significantly expand the group of potential consumers**, and, accordingly, markets

Competitive advantages

Comparison with known analogues:



Actuator dimensions(mm)	0.2-20	30	30 000	50 000
Min object dimensions (nm)	10	30	1 000	3 000
Functional material of the actuator (principle)	TiNiCu (SME)	Si (Thermal expansion)	Piezo Ceramics	Electromagnetic
Working temperature, (°C)	30-60	350	20	Room
Work on the air	Yes	No	Yes	Yes
Bio-objects manipulation	Yes	No	Yes	No

[1] <http://www.nanobits-project.eu/> [2] <http://www.nanotechnik.com/> [3] <http://www.vides-eventum.de>

Science partners



Center for Nanotechnology
and Nanomaterials
of the Republic of Mordovia

Kotelnikov Institute of Radioengineering
and Electronics of RAS



UNICAMP

Cooperation options

Our offer aims to promoting Nanoactuator's technologies for R&D and manufacturing capability of Microfluidic and BioMEMS players in order to commercialize technology and develop merchandise for global markets.

The R&D Program	Technology Transfer Contract	Commercial supply of products
Supply-Tech development type: Introduce Supply-tech from Nanoactuator LLC and conduct the following technology development in order to enhance competence and commercialize technology.	The signed document that shows an agreement to comply with rules and conditions for technology transfer from Nanoactuator LLC to our partner.	On-demand supply of nanoactuator devices or bioMEMS with InP nanowires for use in research, as well as for prototyping various micro sensors, microelectronic devices.

Contacts



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