QNA

QNA Technology

Bringing nano light sources to our daily life.

QNA Technology

WHAT DO WE DO?

Our focus:

- designing, developing and manufacturing semiconductor colloidal quantum dots (QDs),
- modifying the surface of QDs,
- formulating QDs-based inks.

Our current proposal:

- quantum dots (QNA.dots),
- QDs-based inks (QNA.ink).

QNA Technology

OUR GOALS

We would like to become the largest **worldwide supplier/manufacturer of QDs-based inks**.

We would like to **actively participate in the hi-tech revolution leaving an imprint** on high technologies of the future.

Science Focus, 2nd December, 2016

QNA products inside

QNA

Quantum Dots

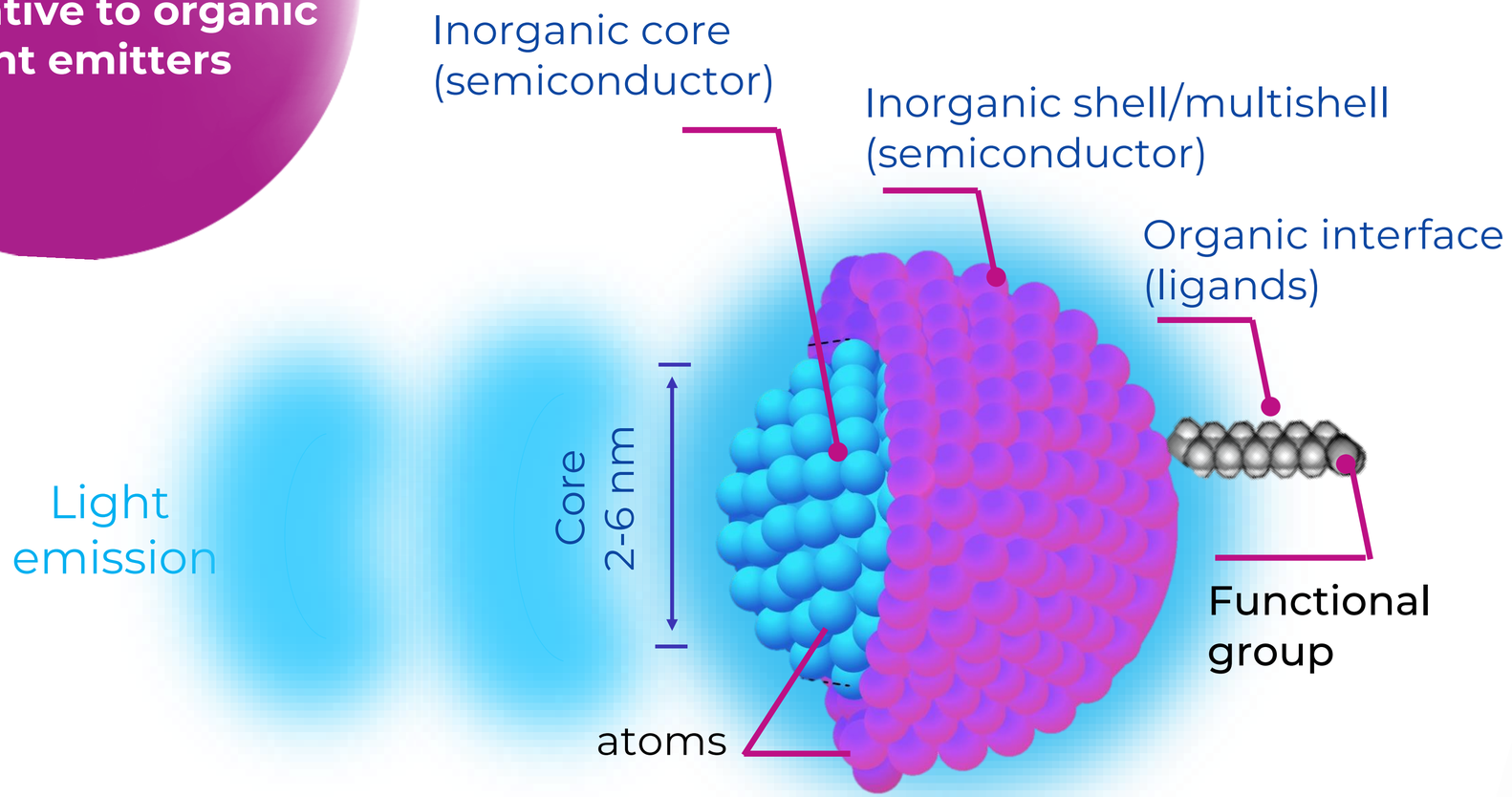
Small dots. Great potential.

Quantum Dots (QDs)

QDs STRUCTURE

Quantum dots are an **alternative to organic light emitters**

Small semiconductor crystals



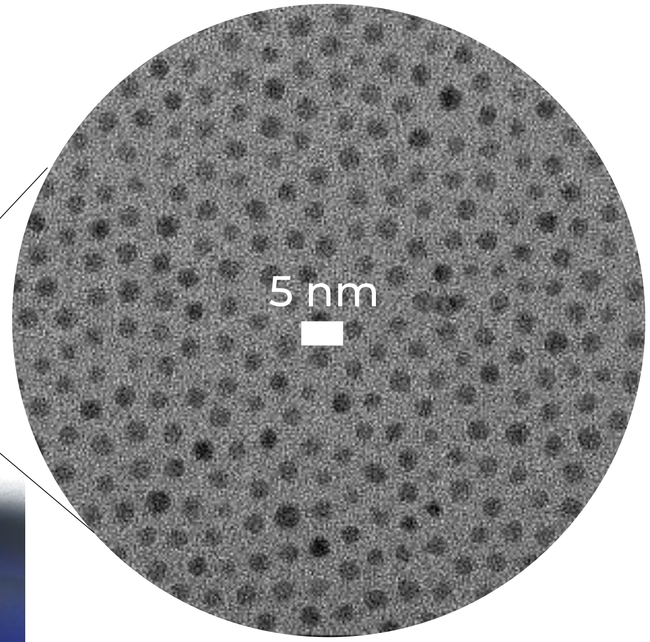
Modifications of chemical surfaces allow for dispersing QDs in **different solvents** & conjugating them with **other structures**

Quantum Dots

HOW DO THEY LOOK?

Semiconductor crystal in colloidal form

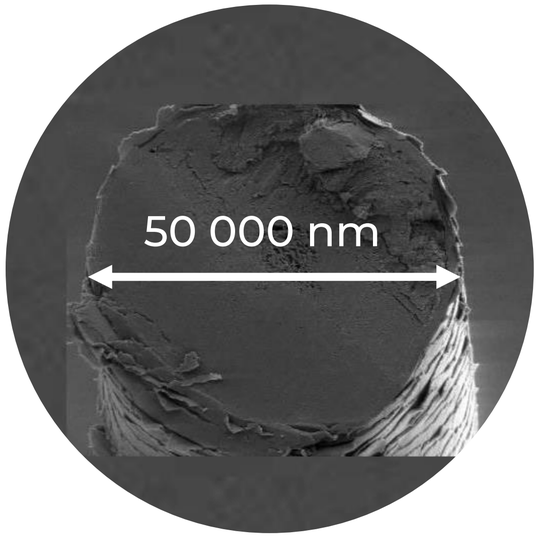
QNA.dots dispersed in solvent



TEM microscope image of **QNA.dots**

1 nm = 10^{-9} m

vs.



SEM microscope image of **human hair**

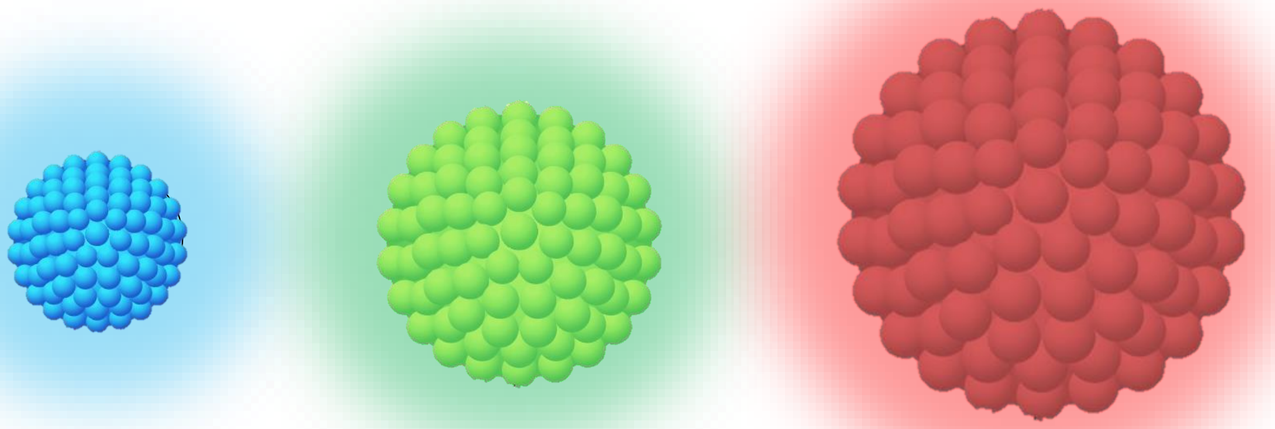
Quantum Dots

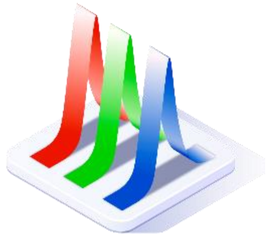
QDs PROPERTIES

Color of QDs emission strongly **depends on QDS size** (number of atoms) and can be tuned continuously from UV to NIR!

Size dependent properties

Same material,
different colors of emission & absorption of light!





High color purity

High stability

High intensity

Flexible form

High surface area

QNA

Quantum Dots

ALL YOU CAN DO WITH ORGANIC DYES
YOU CAN DO BETTER WITH QUANTUM DOTS!

	Organic Dyes	Quantum Dots
High emission quantum yield	-	+
High spectral quality (narrow emission)	-	+
High emission and structural stability	-	+
Environmental resistance	-	+
Wide colour tunability (including NIR)	-	+

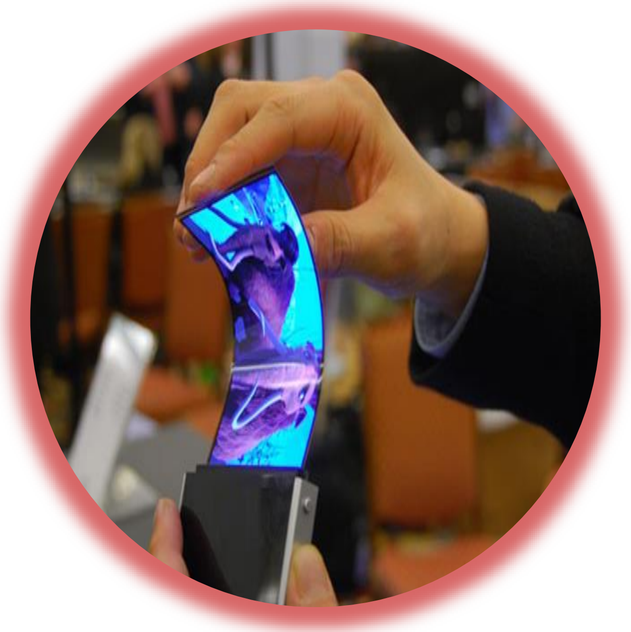
QNA

Quantum Dots

WHAT THEIR POTENTIAL IS ALL ABOUT?

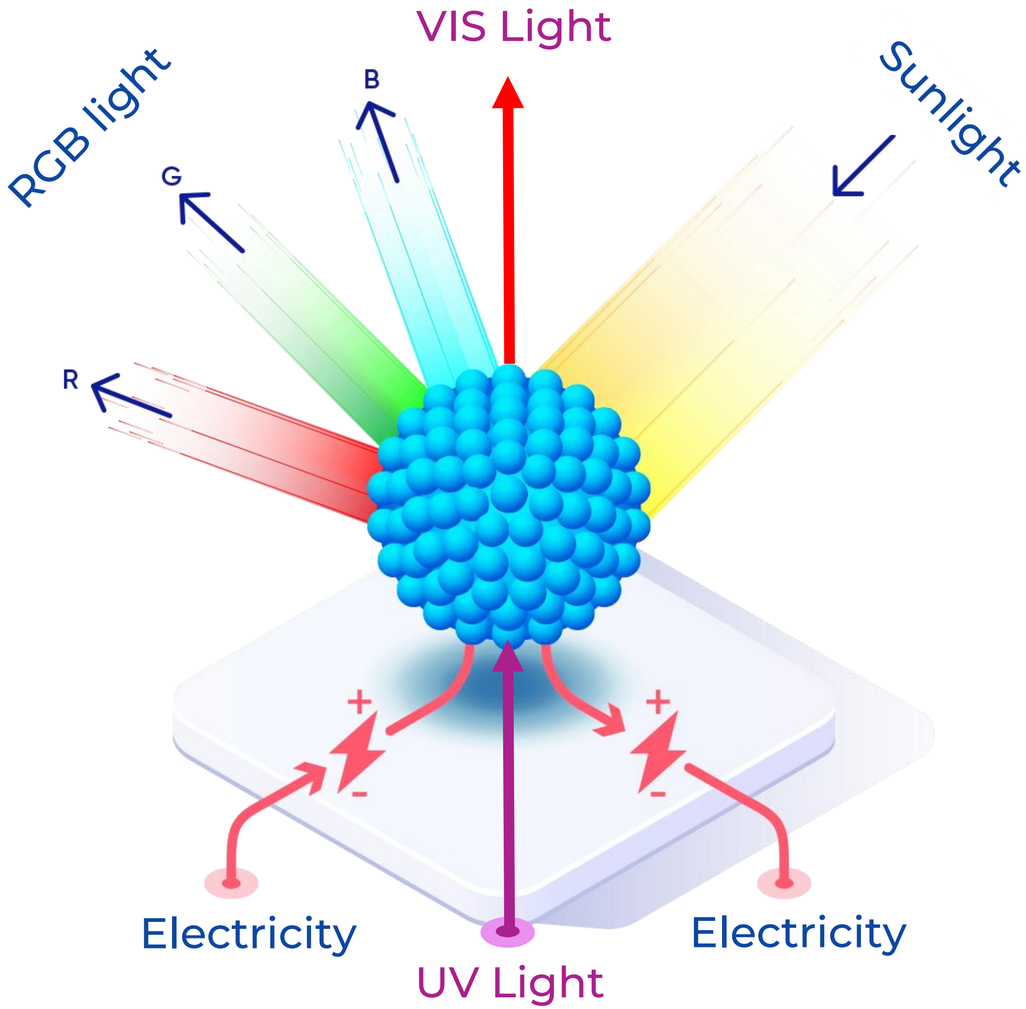
Photonic Technologies

Flexible displays



Display Technology

QDs can convert
electricity into light



Transparent solar cell

Photovoltaic Technology

QDs can convert
light into electricity

QNA Innovation

QDs CHALLANGES

Production technology

Growing high quality QDs on a large scale is an extremlly difficult task!

At QNA Technology we have developed a unique technology based on continuous flow which allows us to grow **large quantities of QDs** without losing any of their **high quality**!

Blue-emitting quantum dot

High-quality cadmium-free QDs emitting blue light have been awaited for long. It is the Holy Grail of display industry!

At QNA Technology we have developed a unique protocol for synthesising blue-emitting QDs.

QDs surface functionalisation

The surface properties of QDs determine their practical use.

At QNA Technology we have developed protocols for surface modification of QDs. This enables us to prepare highly concentrated solutions of QDs in a wide variety of solvents. This innovative concept allow QNA to develop fluorescent QD-based inks.

QNA

QNA Products

Champion quality.

QNA.dots

PRODUCTS IN STOCK

QNA-G.dots

Emission:	520 ± 5 nm
FWHM:	< 30 nm
QY:	> 80%
Ligands:	OA

QNA-L.dots

Emission:	545 ± 5 nm
FWHM:	< 30 nm
QY:	> 85%
Ligands:	OA

QNA-Y.dots

Emission:	590 ± 5 nm
FWHM:	< 40 nm
QY:	> 80%
Ligands:	OA

QNA-R.dots

Emission:	635 ± 5 nm
FWHM:	< 40 nm
QY:	> 60%
Ligands:	OA

To be made available by the end of this year!

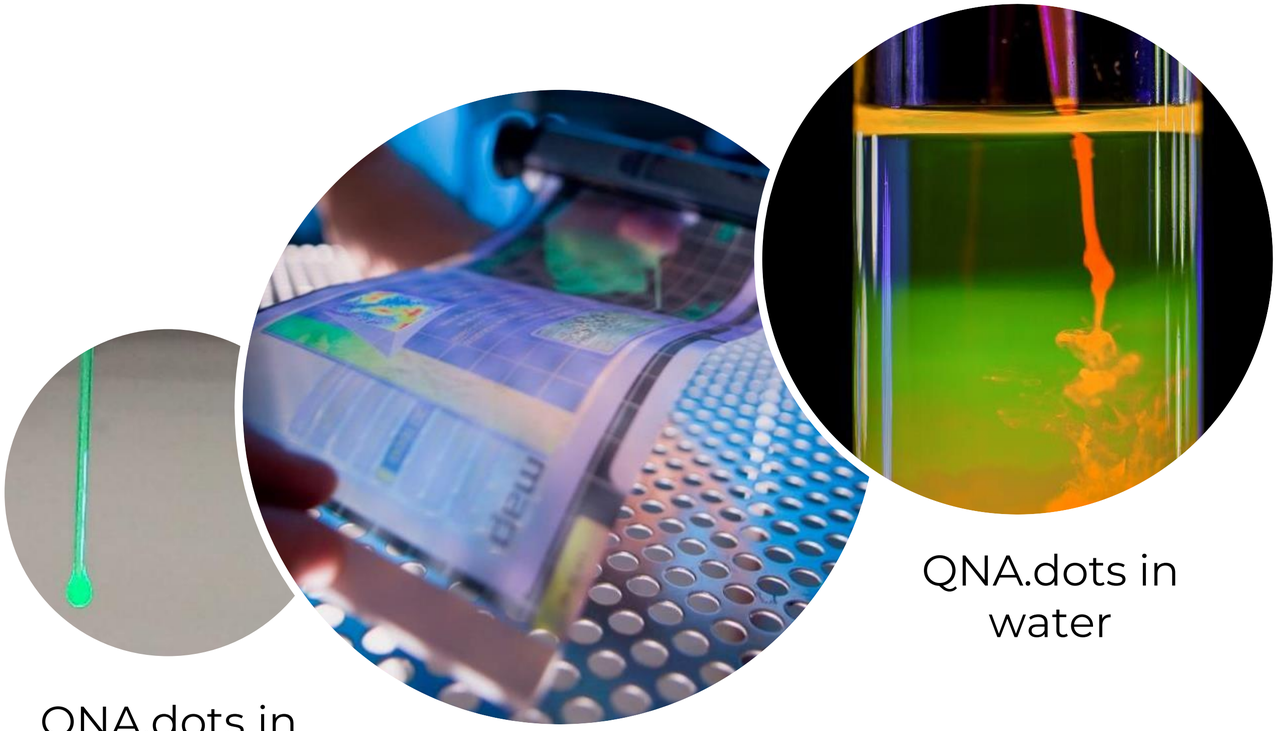
- High production capacity
- Technology ready for further upscaling
- Surface functionalisation upon request
- Other colors are availiable on demand (up to 2000 nm)

QNA.ink

PRODUCT IN DEVELOPMENT PHASE

With semiconducting QNA.ink, making hi-tech devices becomes much easier!

- High production capacity
- Wide range of solvents (polar, nonpolar)
- Wide range of viscosity
- Wide range of surface tension



QNA.dots in lacquer

QNA.dots in water

QNA

Market

Quantum dots are here to stay!

QNA

QDs Market

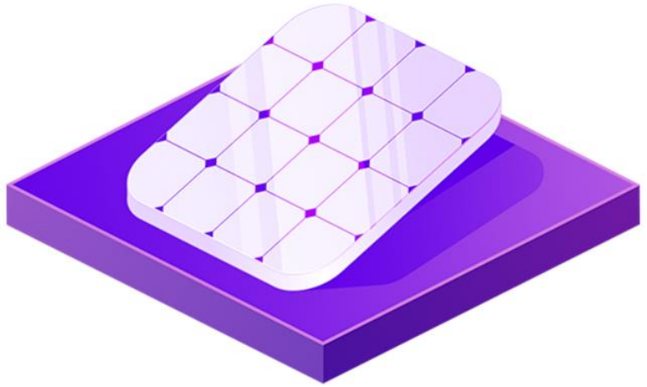
DYNAMIC GROWTH

QDs for Displays

8K and more

Transparent

Flexible

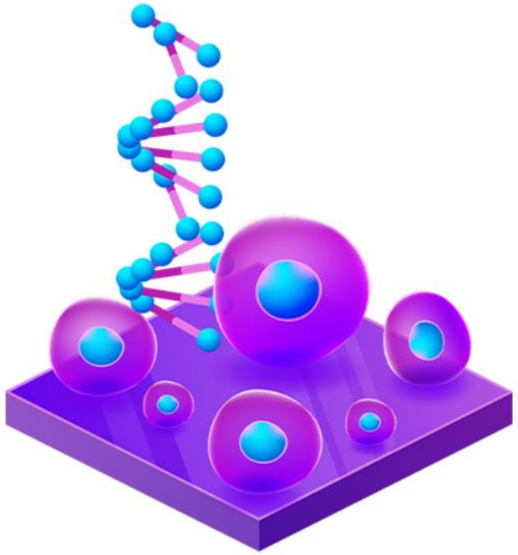


QDs for Photovoltaics

Flexible

Transparent

Efficient



QDs for BioTech

Optical markers:

- In vitro
- Ex vivo
- Intraoperative

Sensors

QDs for Photonics

Light converters

Light concentrators

Light emitters

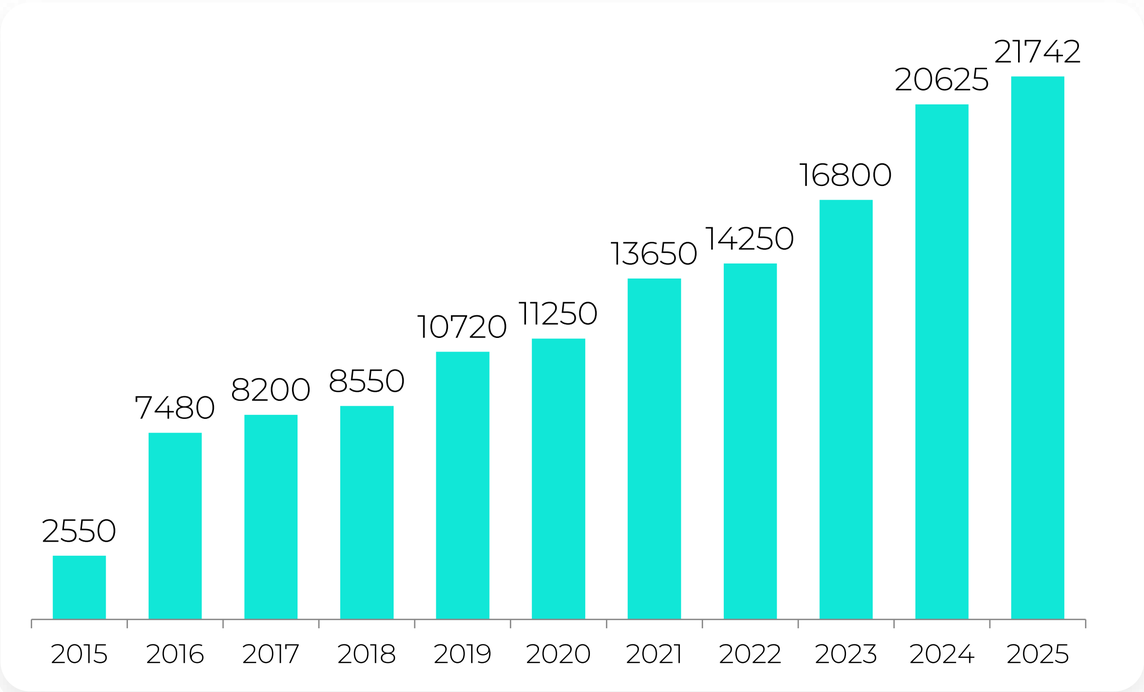
Security inks

and many more ...

QDs Market

PREDICTIONS

Global QD market (in million USD)



An incredible growth of the market.

Source: Future Markets Inc. report 2019

Market summary

Market age:

Development

Potential revenues by 2025 (at the component level):

$21 bilion

Base year market growth rate (2015):

>200 %

Forecast period market growth rate:

15 %

The future of quantum dots

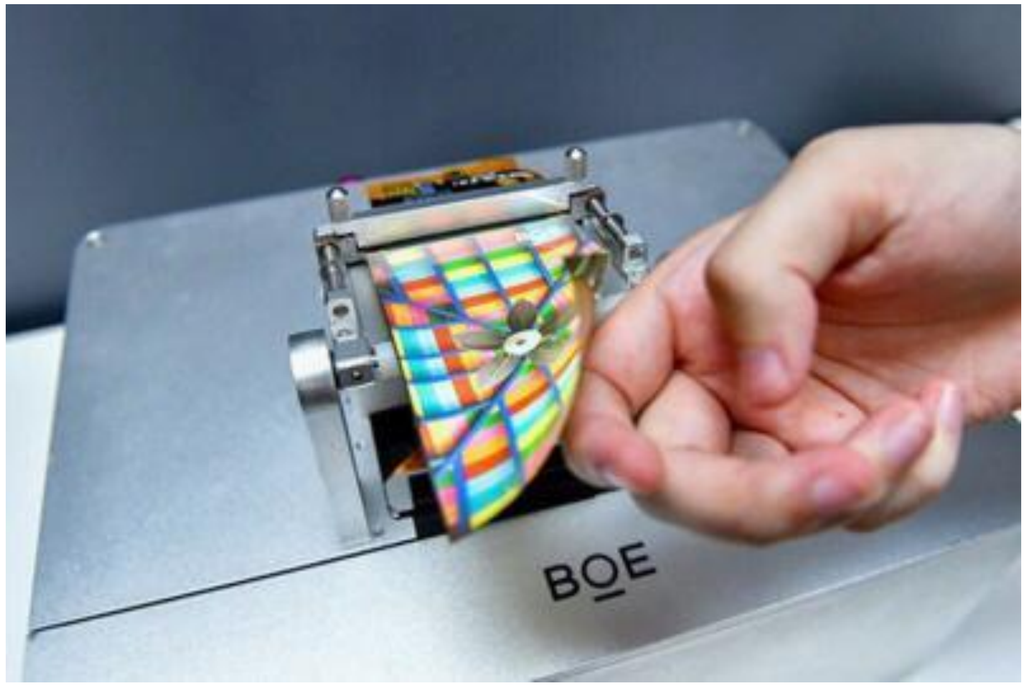
REMARKABLE EXAMPLES OF QDs COMMERCIALISATION

Samsung continues its leadership commitment in setting new standards for picture quality by bringing one giant leap towards reality with its latest QLED 8K TV (*8 May 2019*).

UbiQD Inc. has launched the commercial sales of “UbiGro” greenhouse film: a red light emitting window film that is a groundbreaking advance for greenhouse production (*28 November 2018*).

The future of quantum inks

NEW PRODUCT OPPORTUNITIES



At SID 2018, BOE demonstrated a printed OLED panel for the first time. Ink-jet printed 5-inch AM-OLED display (80 dpi).

The next step is inkjet printed QLED display!

QNA Technology is ready for this step with our QNA.ink !

QNA

Why do you need QDs

An unlimited potential.

QDs Applications

DISPLAY TECHNOLOGY

In 10 years, QD-based displays will dominate our life.

Today

Tomorrow

In the near future, QDs will replace recent display technologies with a new generation of printed QDEL displays:

- transparent
- ultra-thin (light)
- 8K resolution
- flexible
- modular
- low-energy

QDs Applications

DISPLAY TECHNOLOGY

What problems of the display industry could QNA products solve?

Small displays

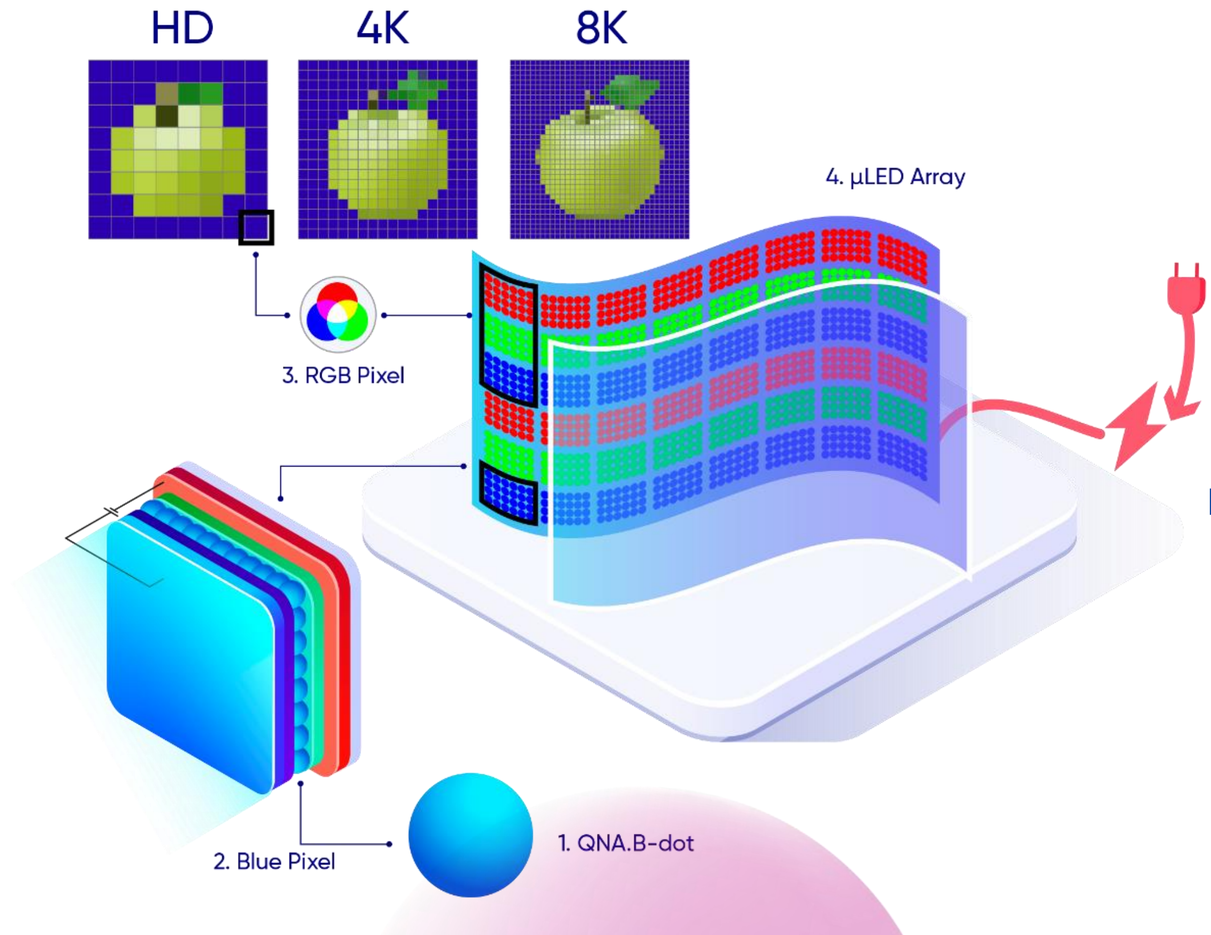
PROBLEM 1

How to obtain high resolution and high image quality on a small display ? (µLED technology).

=

How to obtain small and high quality RGB pixels?

- The high quality blue light emtting QDs is still to be developed!
- A cheep method of small pixels deposition is also missing.



Large displays

PROBLEM 1

How to reduce costs?

How to reduce costs of display production down to 100$/m2 to make them ubiquitous.

PROBLEM 2

How to get new functionalities?

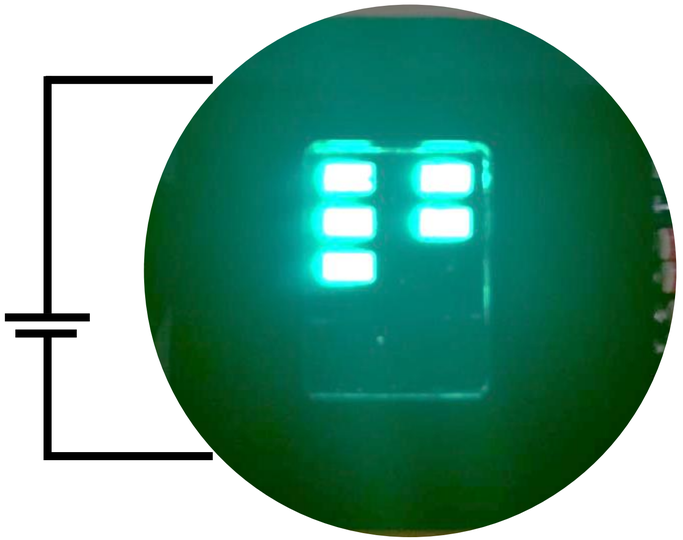
How to obtain flexible/transparent display?

QDs Applications

DISPLAY TECHNOLOGY

How could QNA products help in the display industry ?

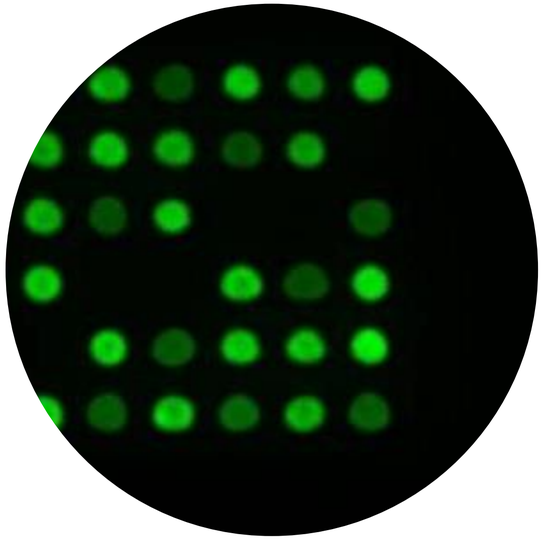
QNA.dots inside



QNA.dots. High quality QNA dots enable the placement of miliLED's on glass or foil.

Pixels for flexible/transparent display technology.

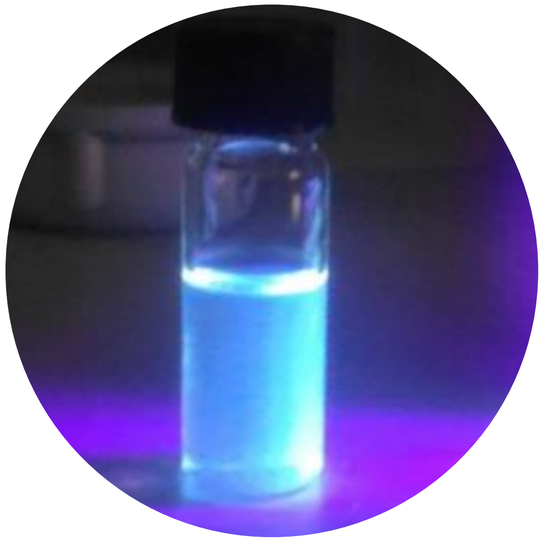
QNA.dots inside



QNA.ink. QNA quantum ink can be used for printing high resolution (<10 μm) pixels and could reduce production costs.

Pixels for 8K small display technology.

QNA.dots inside



QNA.B-dot. Blue light emitting QNA semiconductor dots.

No blue (from RGB) pixels for microQLED display technology.

QDs Applications

OTHER MARKETS

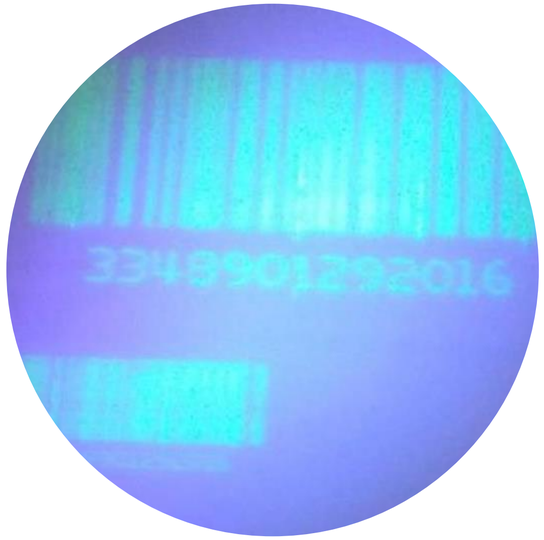
How could QNA products be used in other hitech areas ?

QNA.film inside

Lighting

QNA.films. High quality QNA films change blue LED to any color or spectral response defined by the customer.

QNA.ink inside



Security

QNA.ink. High quality QNA.ink is an excelent choice for unique security code for luxury goods or valuable documents.

QNA products inside

Photovoltaics

QNA.dots. High quality QNA.dots can be used in photovoltaics for making cheap, flexible, and transparent solar panels or solar concentrators.

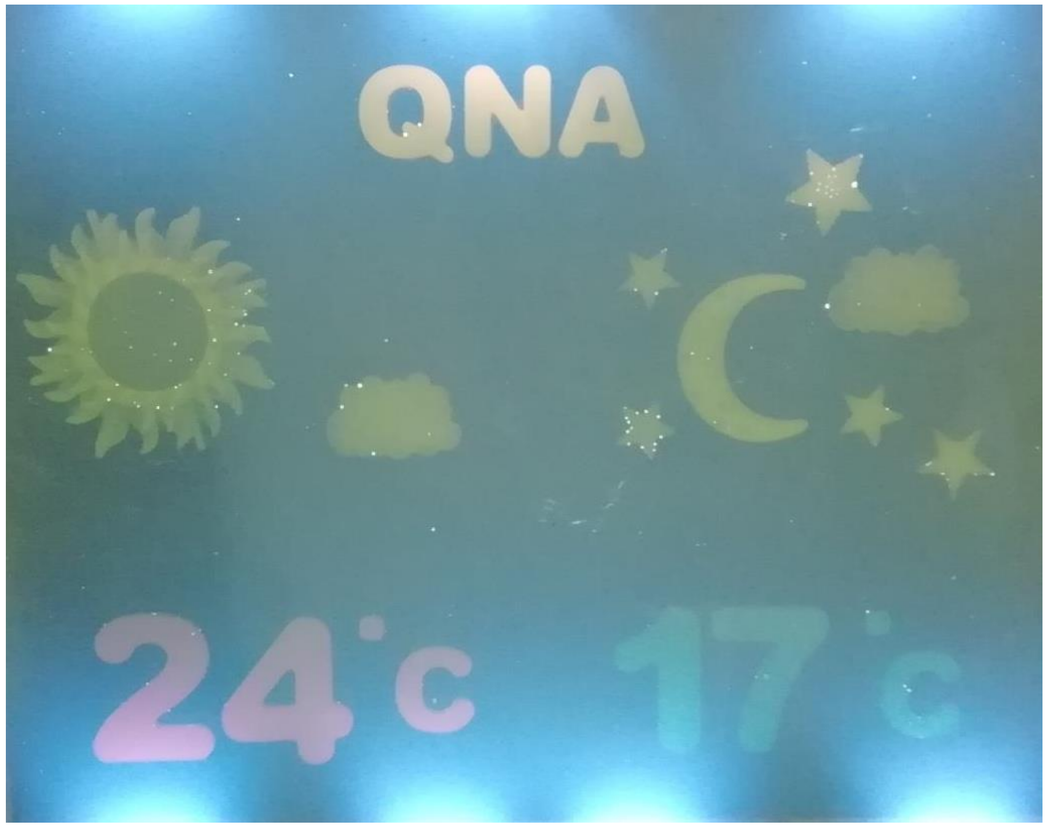
QNA

QNA Prototypes

QNA.dots applied. They do work!

QNA.dots

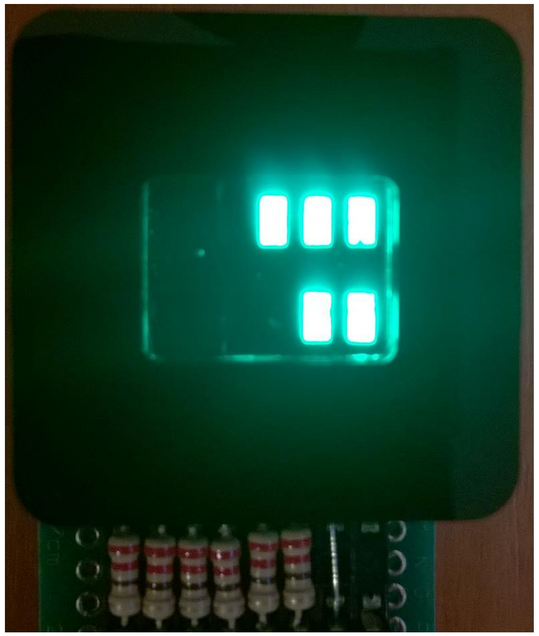
AS PASSIVE DISPLAYS



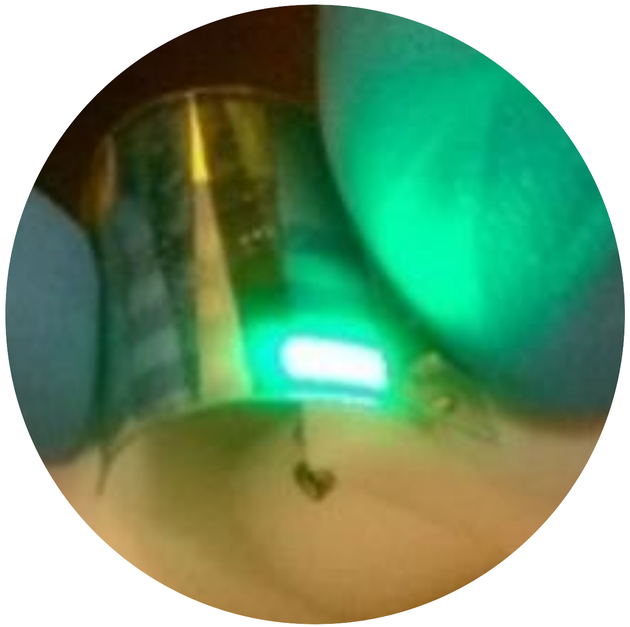
UV light-activated **QNA.dots** embedded inside a transparent matrix.

QNA.dots

AS LIGHT SOURCES



QNA.dots-based LED on glass

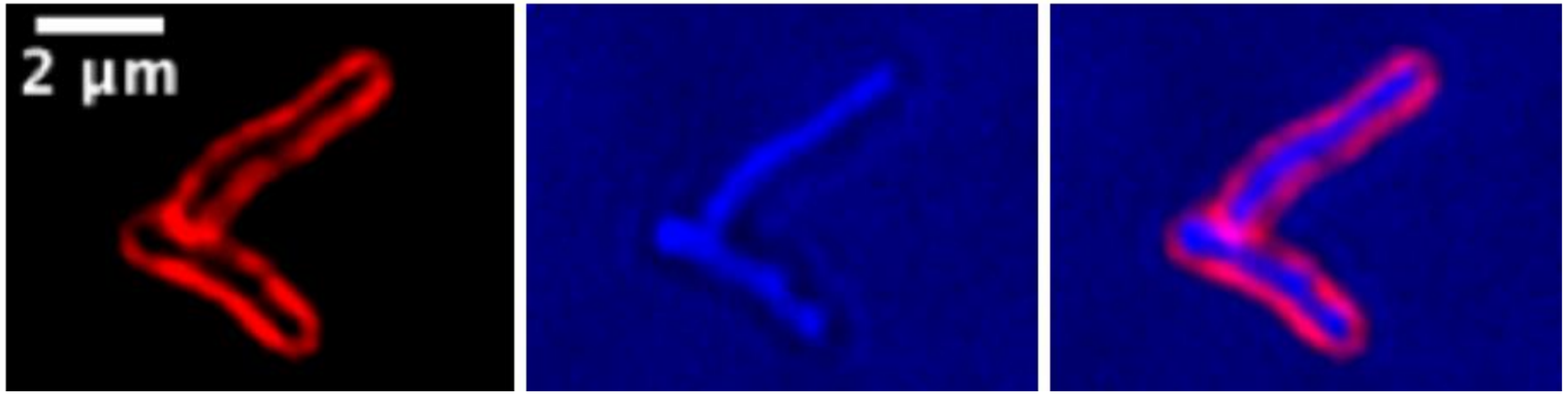


QNA.dots-based LED on an elastic substrate

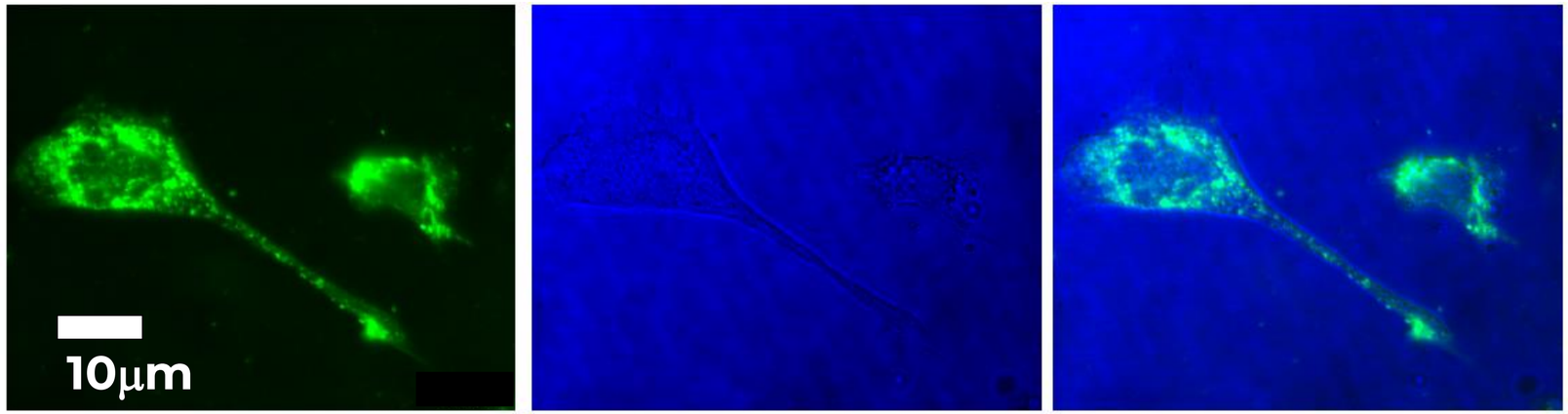
QNA.dots

IN BIOPHOTONICS

Mycobacterium smegmatis (hydrophobic QNA.dots)



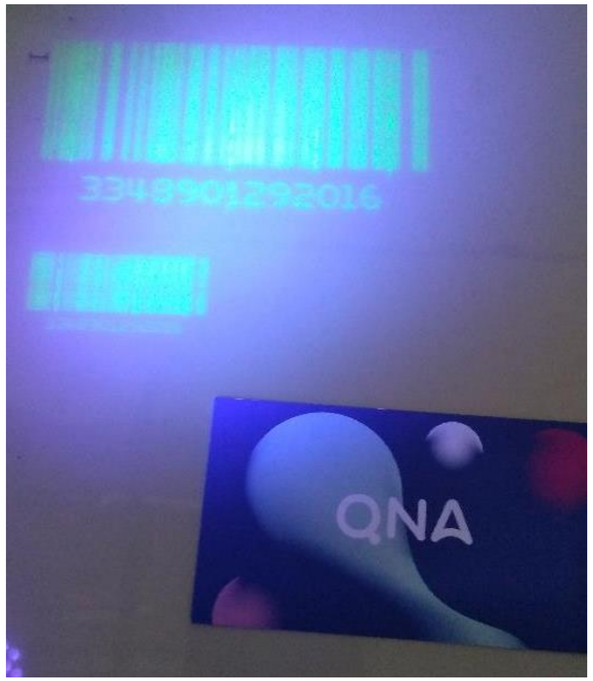
Macrophages (hydrophilic QNA.dots)



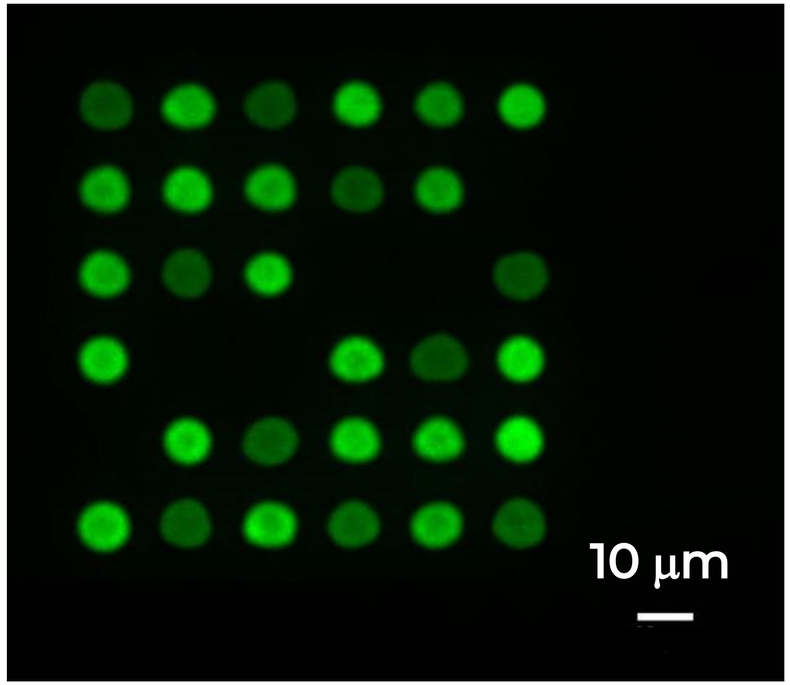
QNA.dots used as optical marker in biological imaging.

QNA.ink

SECURITY&PRINTED OPTOELECTRONICS



Fluorescent QNA.ink printed **on foil** with ink-jet office printer.

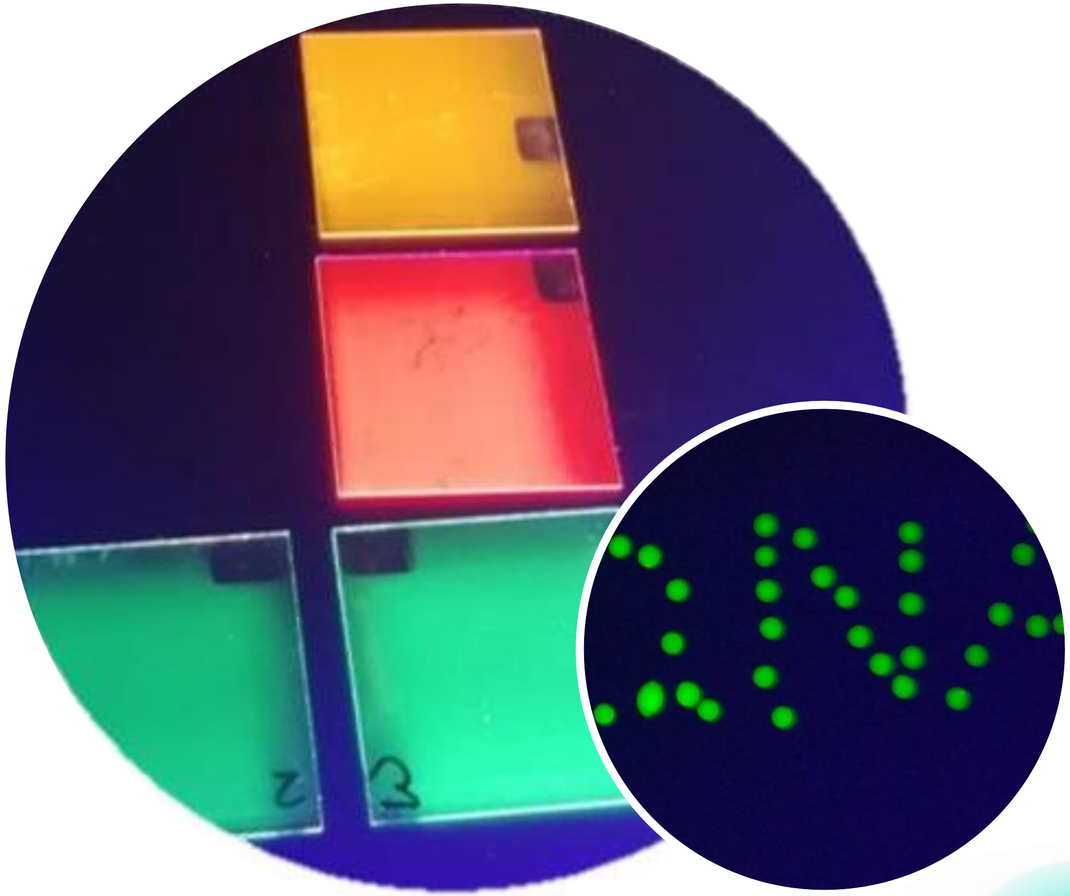


Fluorescent QNA.ink dispensed **on glass** with the XTPL printing technology and an XTPL printer.

A fluorescent logo printed **on paper** with QNA.ink with an ink-jet office printer.

QNA.films

PHOTONICS



Emissive **QNA.films**

QNA.dots deposited onto a glass substrate to form emissive films (**QNA.film**).

QNA

QNA Team

Passion and expertise.

Founders

OVER 15 YEARS OF EXPERIENCE IN R&D WITH NANOMATERIALS

Mateusz Bański
BEng, PhD
CTO

Assistant Professor (Physics) at Wroclaw University of Science and Technology

Artur Podhorodecki
BEng, PhD, DSc
CEO

Professor (Physics) at Wroclaw University of Science and Technology

We have:

- published 100+ scientific papers on nanomaterials
- conducted several large R&D projects in nanotechnology
- a portfolio of patents and patent applications
- won numerous prestigious scientific awards

We have acquired our knowledge at:

- Wroclaw University of Technology (PL)
- Istituto Italiano di Tecnologia (IIT)
- The University of Manchester (UK)
- Sherbrooke University (CA)
- ENS de Cachan (FR)
- Ghent University (BE)
- McMaster University (CA)
- Orsay CNRS, CIMAP (FR)

R&D Team

AN INTERDISCIPLINARY AND WELL-BALANCED TEAM WITH VAST KNOWLEDGE & EXPERIENCE

BEng, PhD, DSc, Prof.

Paweł Pohl

Analytical chemistry

BEng, MSc, PhD

Sławek Drozdek

Biotechnology

BEng, MSc (PhD student)

Hania Woźnica

Nanoengineering

MSc, PhD

Bartek Krajnik

Physics

MSc, PhD

Aleksandra Schejn

Material Engineering

MSc (PhD student)

Monika Czarnecka

Organic chemistry

QNA

Harness the potential of QNA.dots for your own purposes!

Ready for more?

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