

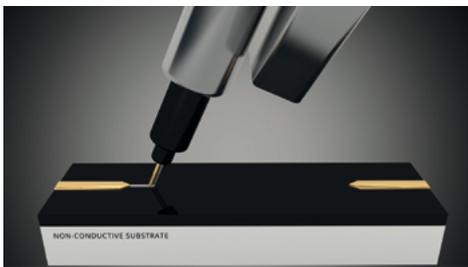
# Ultraprecise printing of nanomaterials. Nanometric conductive lines for various applications.



## COMPANY & TECHNOLOGY

XTPL is a company developing a globally innovative technology, protected by an international patent application, that enables ultra-precise printing of nanomaterials. Our technology is based on solving an interdisciplinary scientific and technological problem, covering challenges in fields such as solid state physics, inorganic chemistry, nanotechnology, material engineering, programming, machine learning algorithms, mechanics and electronics. The printing system designed by XTPL makes it possible to precisely apply to the printing surface a special ink formulated for this purpose in the company's laboratories. Under the influence of an external electric field, the nanoparticles in the ink create conductive lines according to the specified parameters. As such, the thickness of the individual lines (even below 100 nm), their length and the distance between them all vary depending on a specific application. There are numerous physical phenomena that impact the printing process, including electrostatics, electrodynamics, fluid dynamics and molecular dynamics. In order to understand and control these phenomena, we create complex numerical models and uses advanced characteristics of nanoink and printed lines. This allows us to constantly optimize our innovative technology and adapt the process to different implementation requirements.

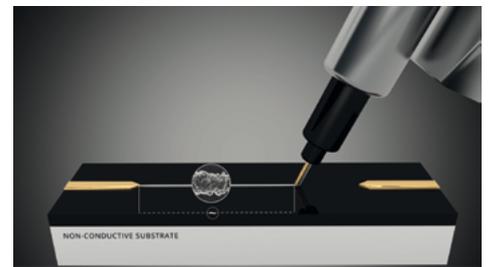
## PROCESS



During the process of line formation, the printing head deposits a properly formulated ink - nanoparticles in a mixture of solvents - on a non-conductive substrate, in example such as glass or flexible foil.



An external alternating electric field causes nanoparticles to assemble in a clearly defined and controlled way to form a line. The process takes place between a stationary and movable electrode.



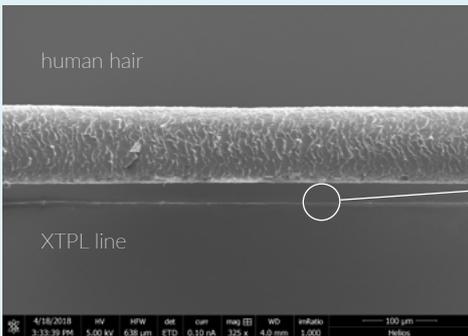
Movable electrode: guides the formation of the line, which becomes an extension of the stationary electrode. Finally, the printing head short-circuits with a metallic pad, and the line connects to the pad while the printing head takes in an excess ink.

## PROPERTIES OF XTPL LINES

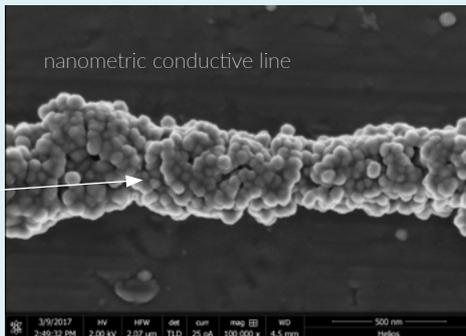
Functionality: electrically conductive, optically, biologically & chemically active  
Nanomaterials: metallic & semiconductor  
Line width: from 100 nm to 15  $\mu\text{m}$

Line length: up to 25 cm range  
Aspect ratio: 1, in the single run of the printing head  
Very low voltage applied: 5-30 V

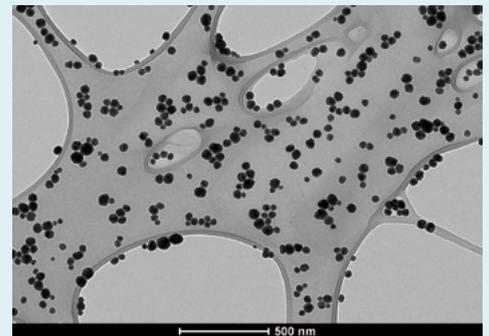
Substrates: i.e. glass, Kapton, PEN, PC, PDMS, PET  
Resistance: 5% bulk Ag, proof of concept manufactured featuring up to 40% bulk Ag



XTPL silver line hundreds times thinner than a human hair flexible, transparent, cost efficient & highly conductive



Nanoprinting will soon revolutionise sectors such as: printed electronics, solar cells, touch screens, wearable electronics, smart packaging, biosensors, anti-counterfeiting & open defect repair



In order to achieve outstanding results XTPL creates own nanoink formulas with nanoparticles of: Ag, Au, Cu, CdS(QD),  $\text{TiO}_2$ , ZnO; different possible shapes: spheres, wires, rods, rice

## PRINTER

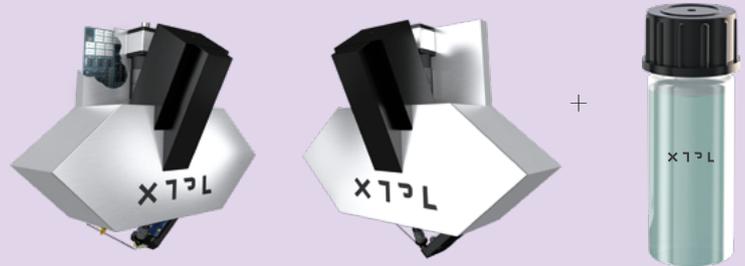
XTPL's printing head, electronics and software algorithms are the core of the system driving the electric field and the assembly process of nanoparticles. This comprehensive solution is implemented in designed & constructed by XTPL Nanometric Lab Printer. It is a device that offers necessary functionalities to test, evaluate and use XTPL line-forming technology with nanometric precision and enables positioning of the printing head with micrometric resolution. Printer's electronics is a top-class control and measurement system ensuring that the process of printing is controlled both by software provided by XTPL and user systems. We deliver the printer with a set of inks, test substrates and a table that ensures proper fixing of samples and thermal control of the printing process. XTPL's technology sets revolutionary standard in nanoprinting.



XTPL Nanometric Lab Printer is dedicated for:

- R&D centres both scientific & commercial
- Joint development projects with potential business partners
- Further development & defining new functionalities in line with specific application areas

TECHNOLOGY CORE - XTPL Printing Head + Nano-Ink



## EXAMPLES OF APPLICATION SEGMENTS

OPEN DEFECT REPAIR - repairing extremely fine broken metallic structures

- solar cells
- displays TFT/LCD/OLED
- integrated circuits (IC)
- printed circuit boards (PCB)
- multichip modules (MCM)
- photolithographic masks

TRANSPARENT CONDUCTIVE FILMS (TCF) for:

- displays
- thin film photovoltaic cells
- touchscreens or smartphone

BIOSENSORS

PRINTED ELECTRONICS

SMART PACKAGING SOLUTIONS

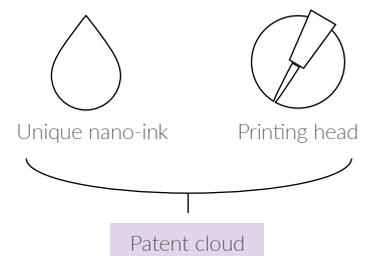
WEARABLES

ANTI-COUNTERFEITING SOLUTIONS

LAB-ON-A-CHIP SOLUTIONS

## INTELLECTUAL PROPERTY

XTPL offers a complete solution for printing electrically conductive lines/structures in nano-scale. This includes proprietary technology, innovative printing-head and dedicated nanoinks (covered by patent applications submitted in collaboration with the British law firm, Gill Jennings & Every LLP. The patent protection will be extended to around 30 countries).



Open for cooperation:

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XTPL is constantly optimizing its innovative technology and adapting the process to different implementation requirements. XTPL aims to build partnerships and strategic alliances with well-established partners in selected sectors and cooperate in the form Joint Development.

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Check us also on: [f](#) [in](#) ▶