XTPL®

shaping global nanofuture

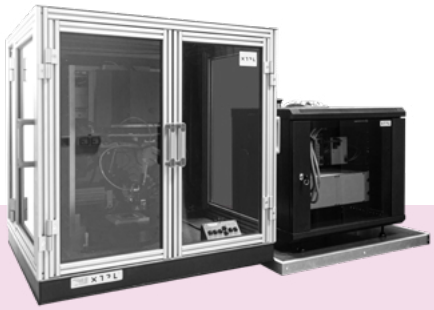
NANOINKS

Developing highly concentrated metallic inks
that overcome dispensing size limitations.

Bringing premium products to the market.

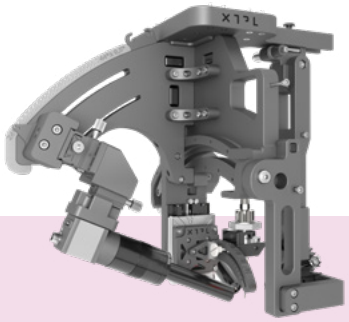
COMPANY & TECHNOLOGY

XTPL is developing globally innovative, additive manufacturing technology that enables ultra-precise printing of nanomaterials. The company provides XTPL® Delta Printing System with Ultra-Precise Deposition (UPD) technology bringing the capability of printing high resolution features down to 1.5 µm. The unique portfolio of XTPL® conductive inks allows to obtain conductive submicron structures on a variety of substrates with diverse printing methods.



XTPL® DELTA PRINTING SYSTEM

high-precision rapid prototyping printing system for microelectronics



XTPL® EPSILON PRINTING MODULE

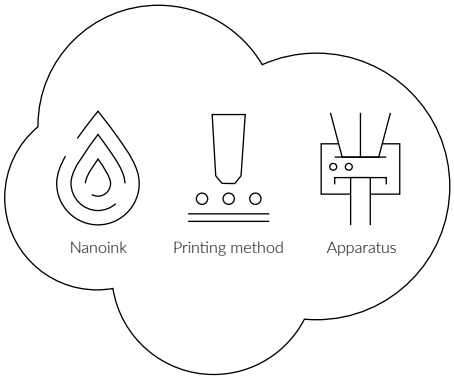
high-precision integratable Printing Module for industrial applications

XTPL® CONDUCTIVE INKS

highly-concentrated silver inks characterised by superior stability and homogeneity

XTPL SERVICES

the services in the field of the proof of concept and prototyping projects



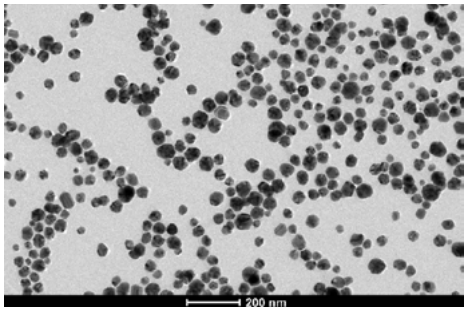
INTELECTUAL PROPERTY

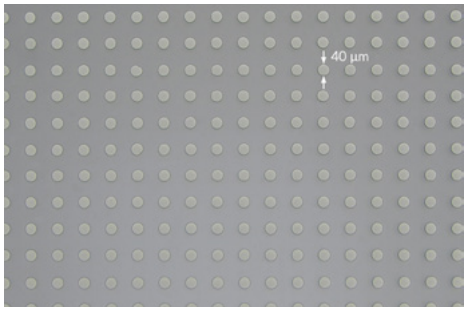
XTPL builds a strong and versatile patent portfolio to protect our inventions in the areas of the printing equipment and printing processes, software development, specific industrial applications, as well as inks.

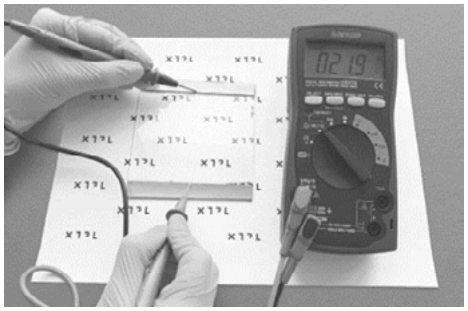
Contact us to get more information info@xtpl.com +48 71 707 22 04 **xtpl.com**

XTPL® NANOINKS BENEFITS

Working on our breakthrough ultra-precise printing technology, we developed a line of highly-concentrated metallic inks (up to 85 wt.%) characterised by superior stability and homogeneity. It is possible to efficiently extrude these inks through micrometer nozzles (even 0.5 µm) without the risk of clogging.







SUPERIOR INK STABILITY

- Secured full manufacturing process: from nanoparticles synthesis to end-product formulation
- Superior ink homogeneity and stability enabling extremely long nozzle lifetime
- Non-clogging behaviour of the ink allowing for continuous efficient printing

HIGH-RESOLUTION PRINTING

- Fine feature printing even on non-planar substrates.
- Uniform well-defined printed functional features
- Excellent wettability on multiple substrates: glass, silicon nitrides, silicon oxides, foils (e.g. Kapton, PET, PEN, PC), silicon wafers

HIGH YIELD OF PRINTED STRUCTURES

- High metal loading (30-85 wt.%)
- Unmatched electrical conductivity up to 50% silver bulk conductivity
- High aspect ratio structures already after single pass

PRINTING METHODS COMPATIBILITY

PRODUCT	IJ36	CL34	CL60	CL85
Metal	Silver			
Average nanoparticles size [nm] (TEM)	35 - 50			
Shape of nanoparticles	Spherical			
Metal content (wt. %)	34 ± 2	30 ± 2	54 – 63	82 ± 2
Electrical resistivity [Ω.m]*	$3.95 \cdot 10^{-8}$	$3.25 \cdot 10^{-8}$	$5.11 \cdot 10^{-8}$	$4.2 \cdot 10^{-8}$
Viscosity (25°C, shear rate = 0.2 s^{-1}) [cP]	26 - 30	200 - 400	30 000 - 50 000	> 100 000
Solvent(s)	Glycol ether	Glycol(s)		
Compatible printing method	Inkjet	• Aerosol Jet (pneumatic atomizers) • Flexography • LIFT • XTPL® Ultra-Precise Deposition	• Direct Ink Writing • LIFT • XTPL® Ultra-Precise Deposition	• Direct Ink Writing • Extruders • LIFT • XTPL® Ultra-Precise Deposition

* For recommended sintering conditions

Ag Nanoink IJ36

Conductive Silver Ink

UNIQUE FEATURES

- superior printing stability – over 1 month of continuous work with repeatable results, and without clogging of the nozzles
- unmatched electrical conductivity – over 40% of bulk Ag conductivity
- high aspect ratio structures – already after single pass printing

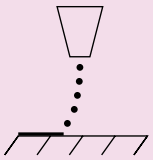
Compatibility with multiple substrates – Kapton 500HN, PET, PEN, PI, PC, Glass substrates

TYPICAL PROPERTIES

Silver content (wt. %)	34 ± 2
Density [g/cm³]	1.2 - 1.4
Average nanoparticles size [nm] (TEM)	35 - 50
Shape of nanoparticles	Spherical
Electrical resistivity [Ω.m]*	$3.95 \cdot 10^{-8}$
Viscosity (25°C, shear rate = 0.2 s^{-1}) [cP]	26 - 30
Surface tension [mN/m] (25°C)	30
Solvent(s)	Glycol ether
Compatible printheads include but are not limited to:	Konica Minolta KM512, KM1024i Fujifilm Dimatix S-class, Samba G3L, DMC

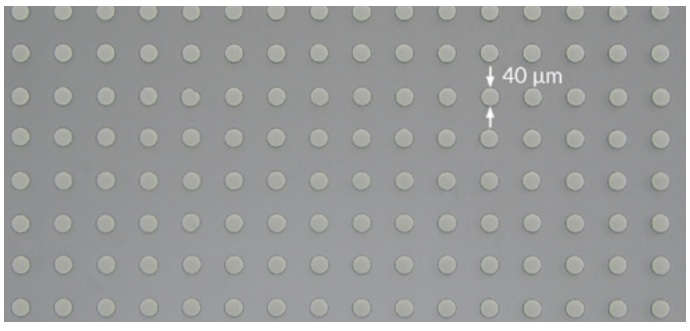
* For recommended sintering conditions

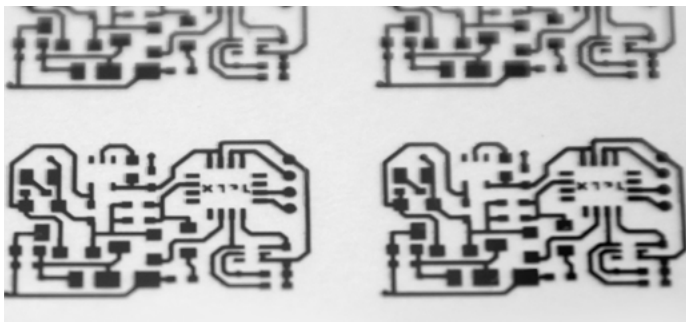
SUITABLE FOR

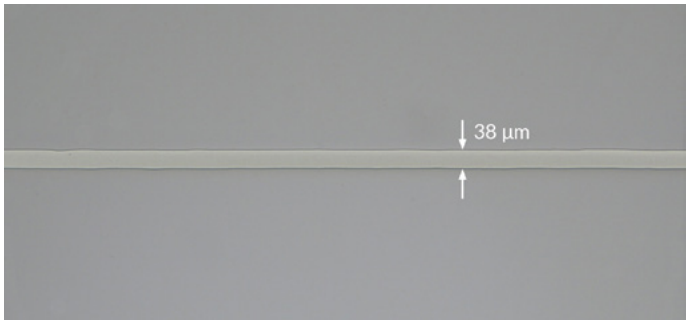


Inkjet

EXAMPLES OF INKJET PRINTED STRUCTURES USING THIS PRODUCT







Ag Nanoink CL34

Conductive Silver Ink

UNIQUE FEATURES

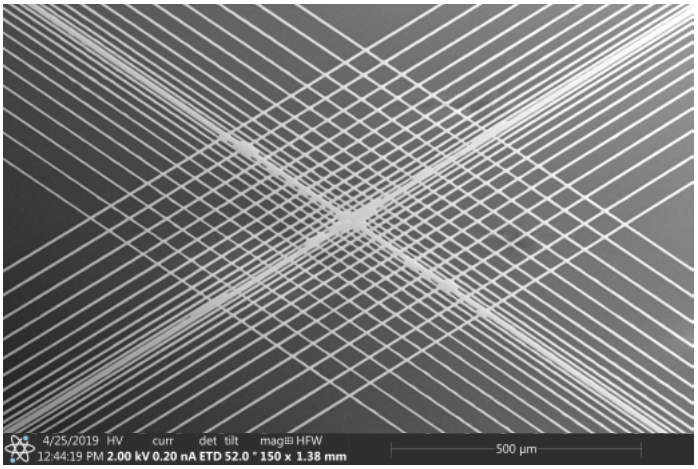
- up to 50% bulk silver conductivity, even at low silver concentration
- printable on foils for the manufacturing of flexible electronics
- suited for applications where low aspect ratio profiles are searched or necessary

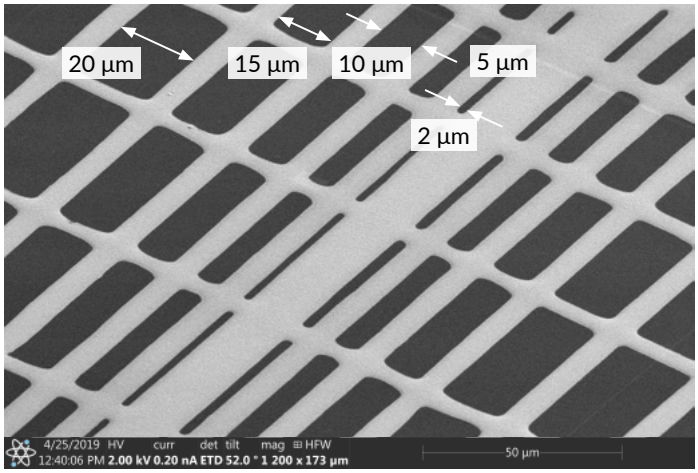
TYPICAL PROPERTIES

Silver content (wt.%)	30 ± 2
Density [g/cm³]	1.50 ± 0.05
Average nanoparticles size [nm] (TEM)	35 - 50
Shape of nanoparticles	Spherical
Electrical resistivity [Ω.m]*	$3.25 \cdot 10^{-8}$
Viscosity (25°C, shear rate = 0.2 s^{-1}) [cP]	200 - 400
Solvent(s)	Glycol(s)

* For recommended sintering conditions

EXAMPLES OF THE STRUCTURES PRINTED USING ULTRA-PRECISE DEPOSITION





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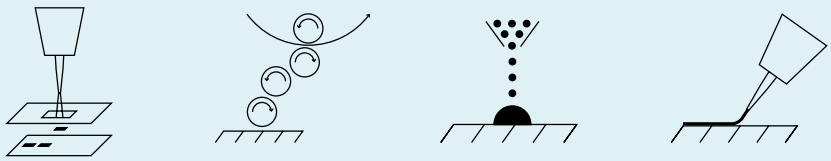


LIFT | Flexography | Aerosol jet | XTPL® Ultra-Precise Deposition

Ag Nanoink CL60

Conductive Silver Ink

UNIQUE FEATURES

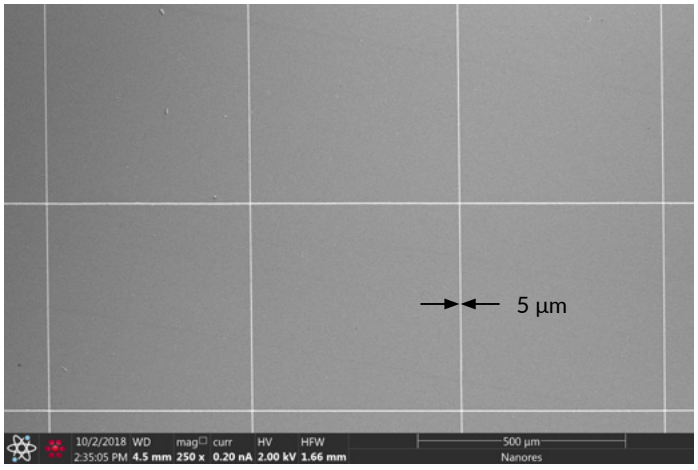
- high viscosity product, enabling the printing of fine features with higher aspect ratios
- easy dispensing, with rheological properties specifically designed for XTPL® Ultra-Precise Deposition and Direct Ink Writing methods

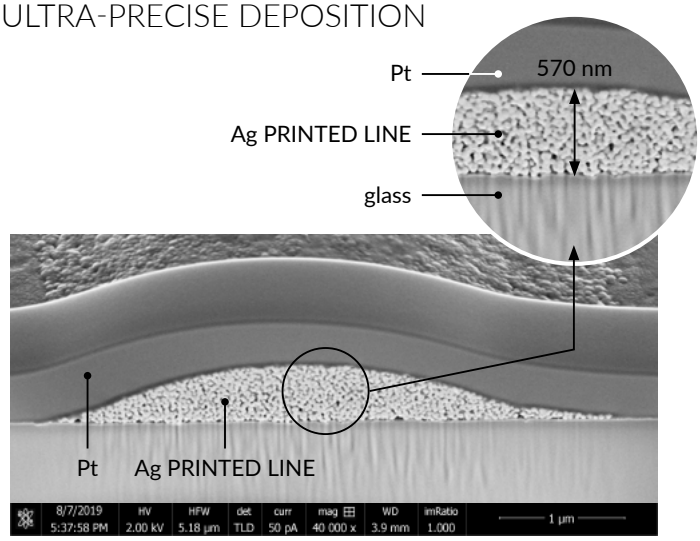
TYPICAL PROPERTIES

Silver content [wt. %]	54 – 63
Density [g/cm^3]	2.00 ± 0.15
Average nanoparticles size [nm] (TEM)	35 - 50
Shape of nanoparticles	Spherical
Electrical resistivity [Ω.m]*	5.11 · 10^{-8}
Viscosity (25°C, shear rate = 0.2 s^{-1}) [cP]	30 000 - 50 000
Solvent(s)	Glycol(s)

* For recommended sintering conditions

EXAMPLES OF THE STRUCTURES PRINTED USING ULTRA-PRECISE DEPOSITION





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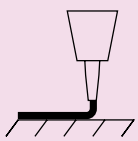
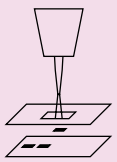
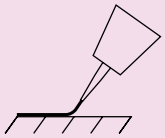


Direct ink writing



LIFT



XTPL® Ultra-Precise Deposition

Ag Nanoink CL85

Conductive Silver Paste

UNIQUE FEATURES

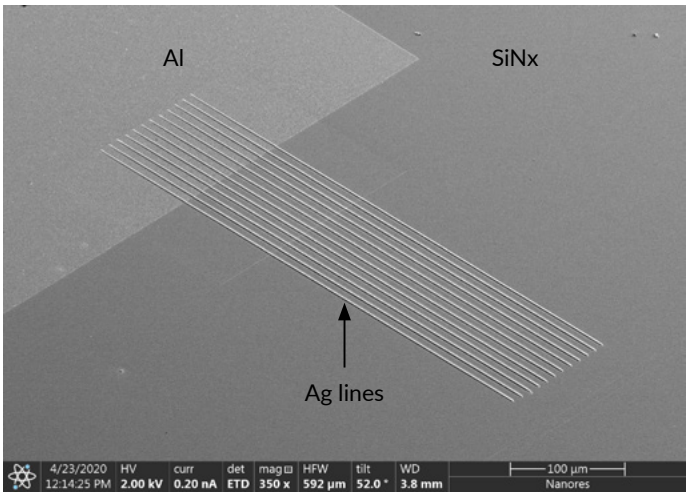
- very high viscosity product, enables the printing of ultrafine features of high aspect ratios
- displays unmatched non-clogging properties, allows long nozzle lifetime (2.5 µm nozzle opening, even more than 1 month of printing)
- dispensable through capillaries as narrow as 1 µm size, resulting in the deposition of homogeneous thin lines

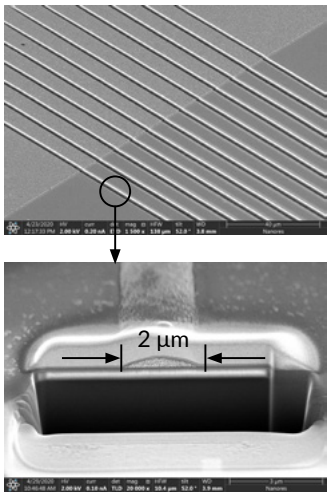
TYPICAL PROPERTIES

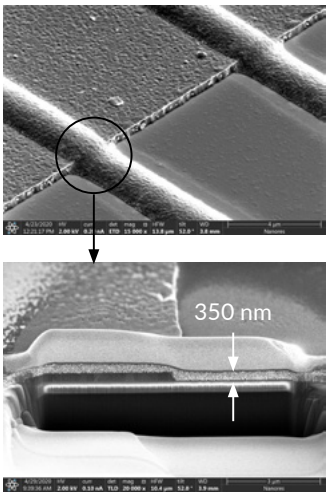
Silver content [wt. %]	82 ± 2
Average nanoparticles size [nm] (TEM)	35 - 50
Shape of nanoparticles	Spherical
Electrical resistivity [Ω.m]*	$4.2 \cdot 10^{-8}$
Viscosity (25°C, shear rate = 0.2 s^{-1}) [cP]	> 100 000
Solvent(s)	Glycol(s)

* For recommended sintering conditions

EXAMPLES OF THE STRUCTURES PRINTED USING ULTRA-PRECISE DEPOSITION







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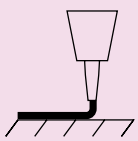
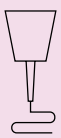
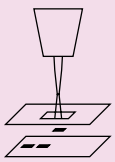


Direct ink writing



Extruders



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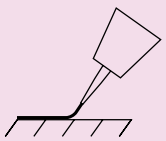

XTPL® Ultra-Precise Deposition

shaping global nanofuture

GET YOUR QUOTATION AT

sales@xtpl.com

+48 71 707 22 04

XTPL nanoinks enable you to shorten your development cycles, and at the same time achieve the required level of resolution and electrical conductivity in a reproducible manner.

XTPL S.A.
Stabłowicka 147
54-066 Wrocław, Poland

xtpl.com