



Inorganic Nanoparticles & Inks



nanograde[®]



About Us

nanograde AG

possesses the most powerful nanomaterials platform and offers the customized development and production of nanoparticles and ink formulations. nanograde enables fast proof-of-concepts, prototype development and speeds up the overall product development cycles of their customers. nanograde's materials are suited for the large scale production of electronic and optical layers.

Offices in Stäfa

Our new and modern facilities are located 30 minutes outside of the city of Zurich at the shores of lake Zurich (220 m² total area). We have close ties to ETH Zurich (Federal Institute of Technology) which gives us access to top-notch analytical instruments.

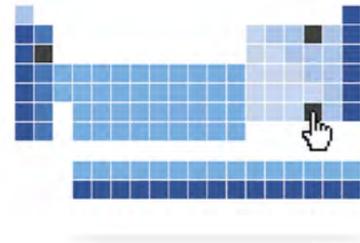
Capabilities

nanograde's expertise lies in the development and production of coating solutions based on inorganic nanoparticles. We have unique problem solving skills making us the preferred partner to create material innovations for cost and material efficient production. We have customers and partners from a wide range of industrial fields, of which many are leaders in their field.

Our patent protected technology and knowhow enable us to adjust our solutions perfectly suiting our customer's needs.

As a Switzerland based company we aim to fulfill the highest quality standards. We deliver rapidly, precisely and reliable. We are committed to perform outstanding product development with our worldwide partner network.

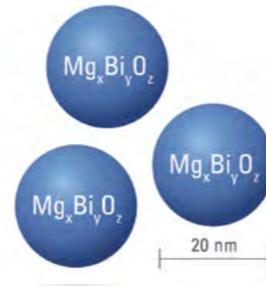
Speciality Nanoparticles



Pick nanoparticle composition on nanograde.ch



We produce and deliver tailor-made nanoparticles



Precise and homogeneous nanoparticles

More than 10'000 compositions, such as

Li₂MoO₄
CaO
MgCO₃
MgTiO₃
AlCeO₃
NaCl
K₂WO₄
CaCO₃
Ca₃(PO₄)₂
Sc₂O₃
V₂O₅
MnMoO₄
FeTiO₃
FePO₄
Co_{0.5}Zn_{0.5}Fe₂O₄
NiCr₂O₄

NaF
ZnSnO₃
NaYF₄
RbF
SrSiO₃
Y₂Eu₂O₃
YSZ
Nb₂O₅
MoO₃
Pt-Rh on support
Ag₃PO₄
ITO
ZnS
ATO
BaZrO₃
CuS

LaAlO₃
CeVO₄
FeS
Al:ZnO
Sm_{0.5}Sr_{0.5}CoO₃
Gd₃Ga₅O₁₂
SrTiO₃
NiO
Er₂O₃
PbO
Mn₃O₄
WO₃
Pt on Ce_xZrO_y
Au on BaTiO₃
PbWO₄
InGaZnO₄

Tailor-made compositions

The value of nanograde is our ability to rapidly produce unique high value nanoparticles. We are able to produce any simple single oxides, but also complex mixed oxides with an unlimited number of different elements and an accuracy down to the ppm level. Metal salt compositions like sulfates, phosphates, carbonates, chlorides, fluorides etc. are also accessible. This means we can create nanoparticles with any physical, electrical or optical property. Please find a selection of compositions on the left.

Advantages

- Rapid materials screening
- Material flexibility
- Uniformity
- Purity
- Reproducibility
- Upscaled to the ton scale

Inorganic Inks, Dispersions & Suspensions



Nanoparticle of choice

Solvent of choice

Inks, dispersions & suspensions



Nanoparticles

ATO
BaSO₄
CaCO₃
Ca₃(PO₄)₂
Co_{0.5}Zn_{0.5}Fe₂O₄
FePO₄
Li₂MoO₄
MoO₃
WO₃
Y₂Eu₂O₃
ZnSnO₃
YSZ
ZnO
etc.



Solvents

Acetone
Butyl acetate
Cyclohexanone
Diethyl ether
Ethanol
Ethyl benzoate
Glycols
Hexane
Isopropanol
Methanol
THF
Water
Xylene
etc.



Deposition

Blade coating
Dip coating
Doctor blading
Flow coating
Inkjet printing
Offset printing
Pad printing
Roll coating
Roll-to-roll coating
Screen printing
Slot-dye coating
Spin coating
Spray coating
etc.

Tailor-made formulations

Our technology allows us to transfer any nanoparticle property into any coating system. We can therefore offer you the highest possible freedom of operation.

Whatever your application is, we support you in the analysis and in the engineering of the best solution for you. We tailor-make our materials to your needs!

Specifications

Arbitrary composition

Choose your composition and deposition technique and we develop the materials just for you.

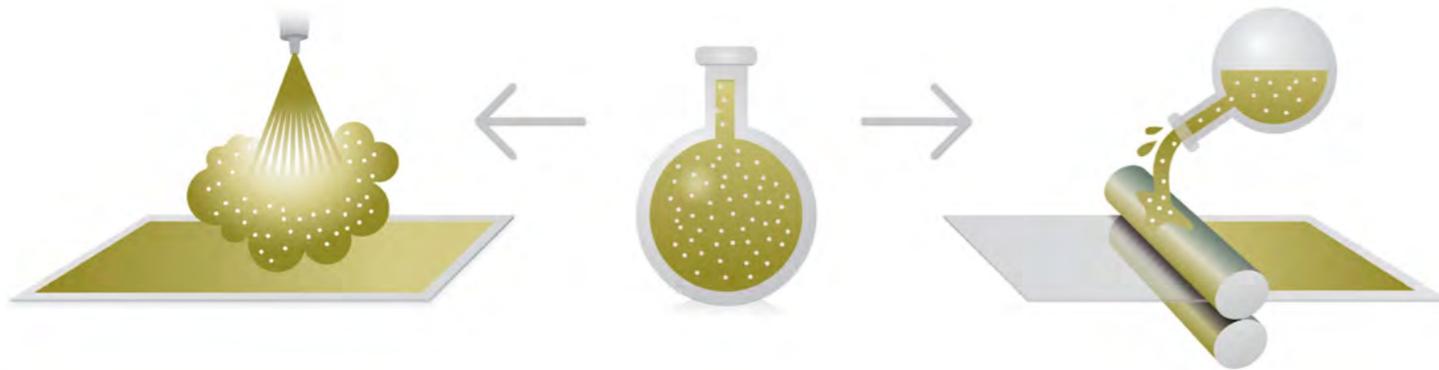
Solvent of choice

Choose from any solvent ranging from water, organic solvents or existing coating systems to UV curable systems.

Further options

Nanoparticle loading, viscosity, processability and many more...

Industries & Applications



Deposition at customer
e.g. via spray coating process

Inks, dispersions & suspensions

Deposition at customer
e.g. via roll-to-roll process

Products

Antireflective materials
Battery materials
Ceramic thin sheets
Charge transport mat.
Downconversion mat.
Fuel cell materials
High-RI materials
Optical materials
Organic electronics
Polymer coatings
Solid polymer fuel cell
Thin films
Traceable liquids
Upconversion materials

Industrial Processing

Blade coating
Dip coating
Doctor blading
Flow coating
Inkjet printing
Offset printing
Pad printing
Roll coating
Roll-to-roll coating
Screen printing
Slot-dye coating
Spin coating
Spray coating

Industries

Aerospace
Automotive
Analytics
Civil Engineering
Communications
Computer & IT
Electrical Engineering
Electronics
Energy
Medical
Packaging
Printing
Solar

Industrially processable

Depending on your existing production process we develop a customized solution facilitating the implementation in your plant. Our solution-based coating technology is perfectly suited for continuous high-capacity production like roll-to-roll coating or digital printing.

Final product

Pure nanoparticle thin films

Can be processed via water- or solvent-based dispersions. Typical film thickness: 10 nm - 1 micron.

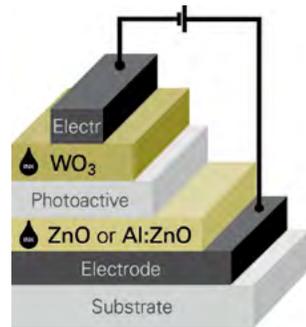
Hybrid films / polymer coatings

We equip existing polymer coating systems with nanoparticles for new or enhanced properties.

Liquid nanoparticle dispersions

Up to 50 wt% nanoparticle content in any given solvent.

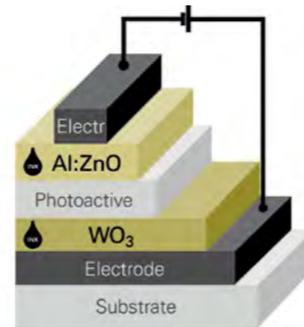
Industrial Examples



Inverted structure



nanograde ink is printed via slot-dye, ink jet, doctor-blading etc.



Normal structure

Solution processed buffer layers

Industry

Organic and printed electronics.

Field

OLEDs, OPVs, etc.

Product

Charge transport layers (HTL / ETL).

Problem to be solved

Processability, lifetime and compatibility of HTL / ETL with organic materials.

Innovation potential

Setting the industry standard for solution processed buffer layers with long life time.

nanograde solution

nanograde N-10, N-10X, P-10 based on ZnO, Al:ZnO and WO_3 in isopropanol.

Result

HTL and ETL ink printed on hydrophilic and hydrophobic substrates; processing $T < 80^\circ C$; good performance; competitive price.

Light management coatings

Industry

Optics, electronics.

Field

Optical coatings for solar cells, lighting (OLED) and displays (LCD, OLED).

Product

Coatings with tunable refractive index (RI).

Problem

Vacuum deposition of high RI coatings inflexible and not economic.

Innovation potential

Replacing vacuum deposition, minimizing coloration and haze.

nanograde solution

Development of highly stable and transparent suspensions of high RI materials.

Result

Highly transparent hybrid coatings with $RI > 1.8$.

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