

LB nano

Ultra-pure nanoparticles, sputter and PECVD nanocomposite co-deposition setup

Introduction

The LB nano platform combines nanoparticles (NPs) synthesis and matrix deposition in a single vacuum vessel, enabling the production of Safe and sustainable by design (SSbD) nanocomposite coatings that cannot be achieved by wet-chemistry routes.

Metal NPs of 2–50 nm diameter and purity $\geq 99.999\%$ are synthesised ligand-free and embedded into functional matrix layers (oxide, polymer, or hybrid) without any liquid, solvent, or organic contaminant.

The result is a class of nanocomposite thin films with tunable optical, catalytic, electrical, and antibacterial properties on large substrates, including flexible webs and thermally sensitive foils.

Established academic and industrial partnerships make LB nano the reference platform in Europe for gas-aggregation nanocomposite research and scale-up.

Applications

Sensing and Detection

- Flexible strain sensors
- Plasmonic gas sensors

Sustainable Coatings & Packaging

- Photocatalytic, easy to clean surfaces
- High-barrier flexible packaging, pinhole-free plasma polymer coatings

Health and Antibacterial Surfaces

- Antibacterial and antifouling layers on membranes for water treatment
- Metal NPs for advanced cancer therapies and contrast agents

Photonics, Optics & Security

- Plasmonic absorbers e. g. for sensing, optic and decorative applications
- Photochromic security labels

Energy and Catalysis

- PEM & AEM fuel-cell and electrolyser catalyst layers for HER reaction
- Photothermal catalysis for NH_3 cracking

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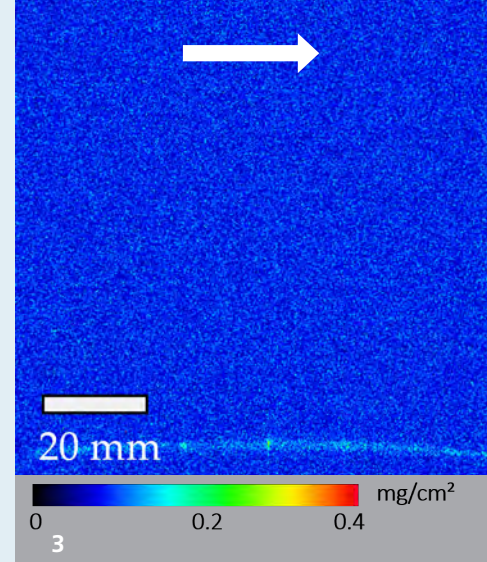
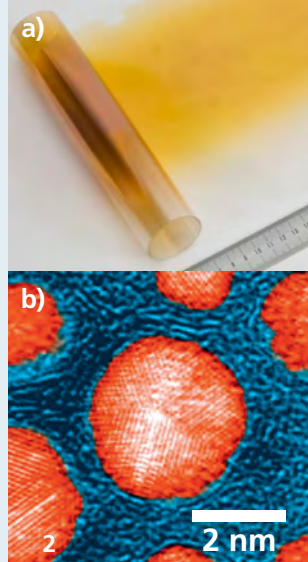
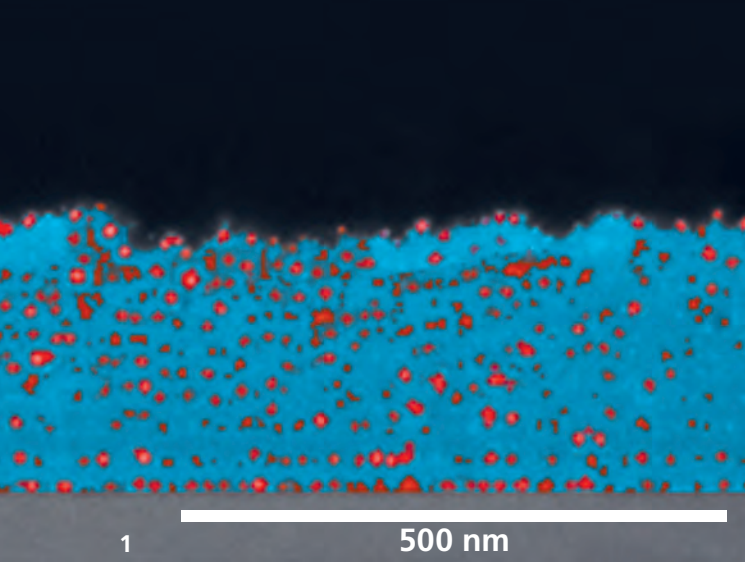
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Our offer

- Synthesis of NPs
- Deposition of plasma polymer layers
- Deposition of multilayers and gradient layers with varying fill-factors

on a wide variety of possible substrates:

- Flat substrates (340 × 100 mm)
- Polymer foils (200 mm width)
- Collection medium (Si, cellulose, PDMS)

Flexible choice of materials for the nano-composite thin films deposition:

- Inorganic NPs (metals, semiconductors, oxides, inorganic compounds)
- Organic & inorganic matrix materials (plasma polymers, oxides, metals, amorphous layers)

Technical specifications

NPs source	• Gas flow sputter source (hollow cathode type, 10kW) • $\varnothing$ 2–50 nm; Ag, Pt, Cu, Au, Ti, W, V, Sn, Mg + other metals
Matrix sources	• PECVD linear plasma source (VHF 60 MHz, 300 W) • Pulsed-DC reactive magnetron sputter source
Deposition rates	NPs: 15–60 nm/min (~10 mg/h eq.) Matrix: 5–200 nm/min
Max. substrate size	Flat: 340 × 100 × 10 mm. Flex. Webs: 200 × 1250 mm
Substrate exchange	Laminar flow box (ISO Class 6 cleanroom, DIN EN ISO 14644-1)
Process pressure	1 ... 150 Pa
Base pressure	10^{-4} Pa
In-situ-analysis	Optical emission spectroscopy, I-V curve, quartz micro balance

Technologies

NP Source – PVD process

- Gas Flow Sputtering of any solid metal
- Reactive sputtering mode also possible

Matrix source – PECVD process

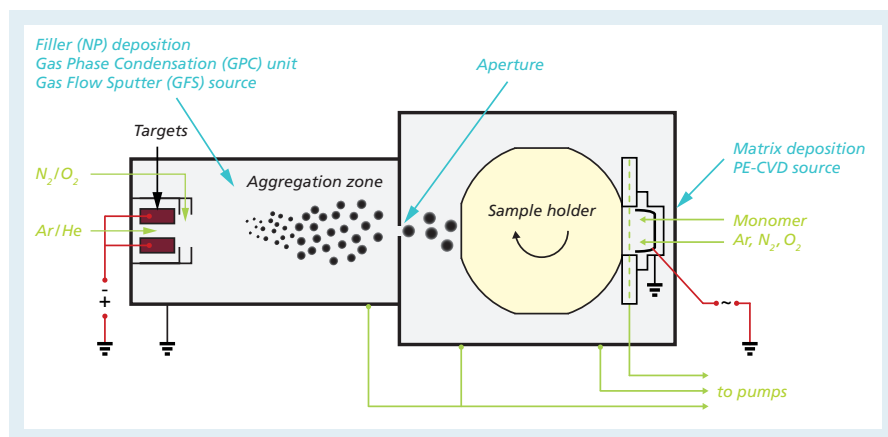
- VHF source for the embedding of nanoparticles in ceramic (PECVD) or organic (plasma polymer) matrix layers
- Monomer precursors: silicon or carbon-based compounds (i.e. Siloxane, Isoprene, fluorinated benzene)

Matrix source – PVD process

- Magnetron Sputter source for the deposition from solid target material
- Pulsed DC Reactive Sputter operation for the deposition of oxide and nitride matrix layers, HF sputtering possible

Safe and Sustainable by Design (SSbD)

- Validated 3-tier NP-exposure protocol, documented NP concentrations and lung deposition modelling for usual materials
- Most comprehensive GFS operator safety dataset in Europe, providing regulatory base required for SSbD compliance



Schematic representation of the LB nano

- 1 SEM cross-section micrograph of multi-layer deposition with Ag-NPs and SiOx PECVD matrix
- 2 a) Deposition of Ag NPs SiOx nanocomposites over > 100 × 1250 mm (rotation mode)
b) TEM image of Pt NPs deposited by GFS with the LB nano system
- 3 μ -XRF homogeneity for Pt (rotation mode)