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Fraunhofer Institute for
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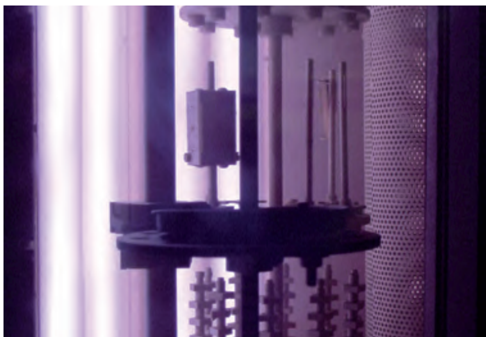
UNIVERSA

Laboratory coater for 3D layer deposition by means of pulse magnetron sputtering

Laboratory coater UNIVERSA



View into the coating chamber

One of the business units at Fraunhofer FEP develops technologies for the coating of shaped substrates with non-planar geometry.

Depending on the type of coating, the corrosion, scratch or wear resistance of components can be increased. Decorative appearance and other specific functionalities can also be realized by selecting suitable coating materials.

In our experimental plant, UNIVERSA, we can process components of any material.

The technological setup enables plasma precleaning (plasma etching) of the components, sputtering of adhesion promoting layers as well as coating by high-performance pulse sputtering processes.

For the deposition of various metallic or non-metallic coating materials, both non-reactive and reactive coating methods can be used.

One main focus of our work is the optimization of technological processes and substrate handling for component treatment in order to adapt the functionality of the coating to the requirements of the application and the substrate properties.

The advantage of vacuum coating compared to conventional wet-chemical or metallurgical coating processes for components lies in the achievable high layer quality and the wide range of layer structures that can be produced. Environmental soundness and cost efficiency are further benefits of the technology.

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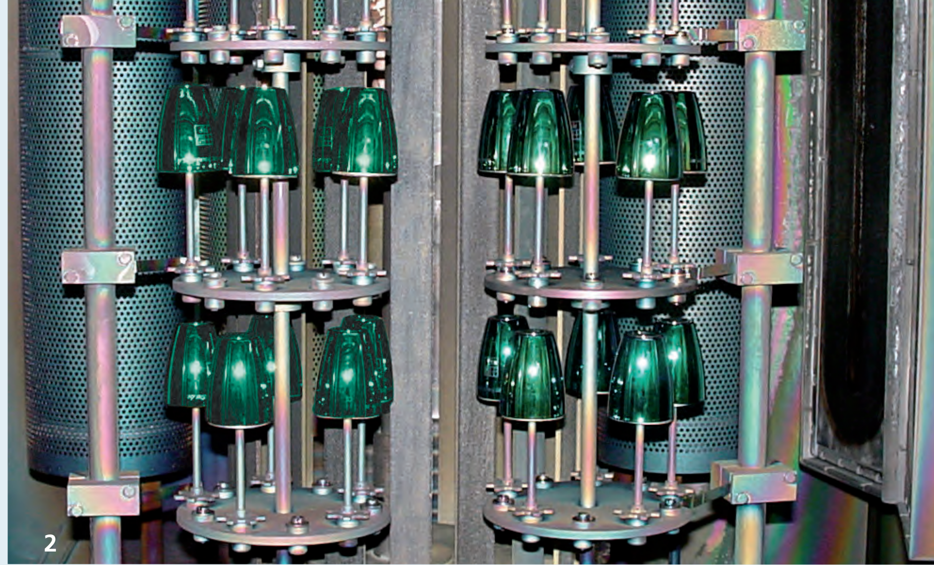
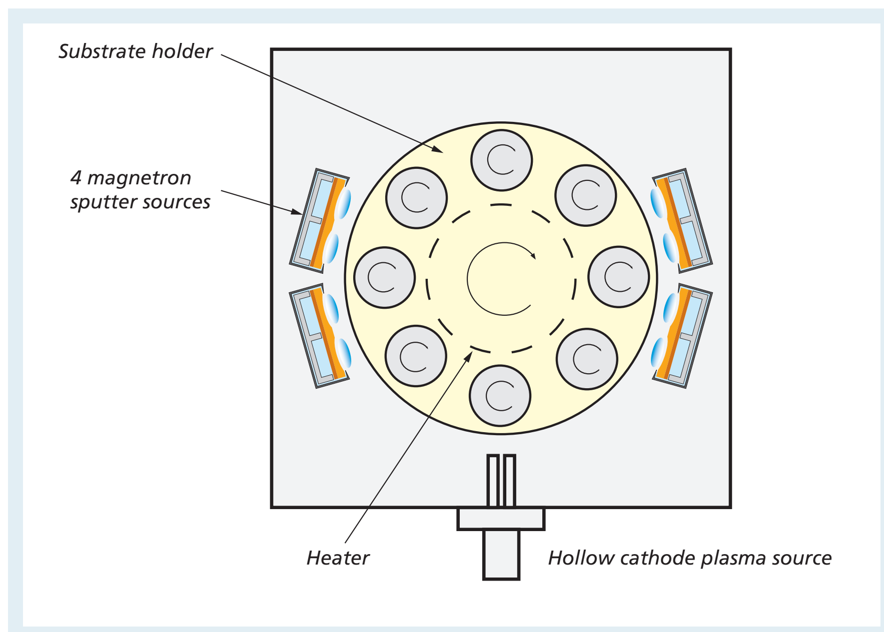


Technical specifications

Coating chamber	1500 l-batch-coater with rotary substrate holder and substrate heater
Coating modules	4 magnetron sources
Target dimensions	512 × 128 mm^2
2 sputter pulse power supplies	60 kW, 1000 V, max. 1000 A pulse current at up to 50 kHz pulse frequency
Pulse power supply for etching and bias	20 kW, 1000 V, max. 60 A pulse current at up to 33 kHz pulse frequency
Hollow cathode module	200 A
Max. substrate dimensions for 400°C-technology	ca. 500 × 500 × 500 mm^3
Max. substrate dimensions for 700°C-technology	ca. 150 × 70 × 70 mm^3
Computer-controlled operation and data acquisition	



Scheme of UNIVERSA

Technology

Pulse magnetron sputtering

- Deposition of single layers or layer stacks (also gradient and multi-layers) by means of pulse magnetron sputtering
- Deposition of compound layers by reactive sputtering
- Operation modes: DC, unipolar pulsing, bipolar pulsing, pulse package
- Deposition of ternary (quaternary) layers of changing composition by reactive co-sputtering of materials
- High reproducibility and long-term stability due to fast feedback process control
- Combination of hollow cathode arc discharge and pulse magnetron sputtering
- Plasma pre-treatment by means of hollow cathode assisted pulse-etching
- Increase and stabilization of substrate temperature by a radiation heater (max. 40 kW)
- Rotation of substrates around up to 3 parallel axes

Our offer

- Technology and process development
- Feasibility studies
- Coating of samples

1 *Coated components from additive manufacturing (Fraunhofer IFAM)*
2 *Decorative color coating*

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