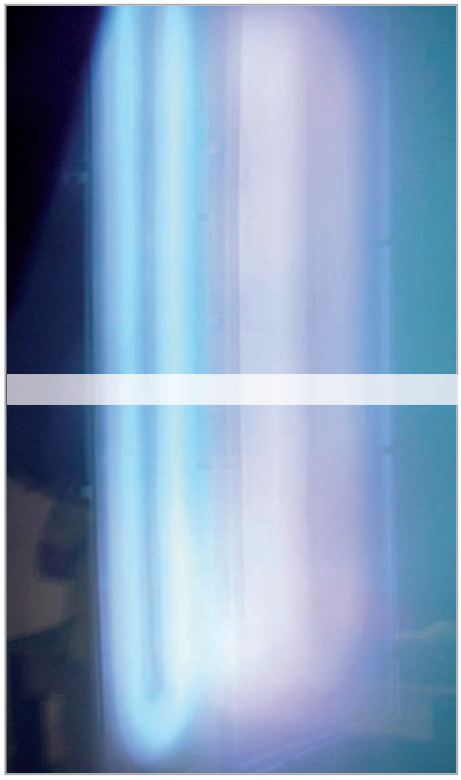
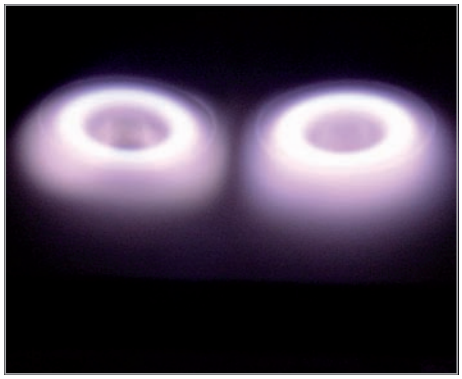
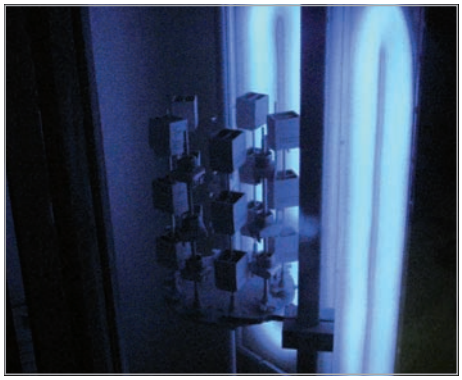
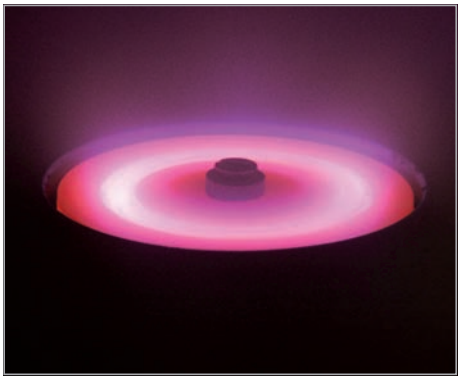




PULSE MAGNETRON SPUTTERING





Pulse Magnetron Sputtering

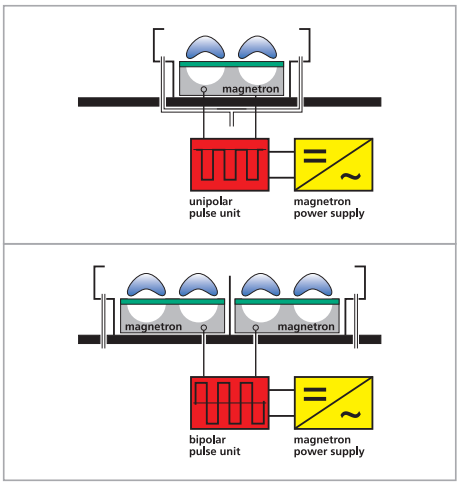
Coating of components and tools

Fraunhofer FEP

Technologies

Pulse magnetron sputtering (PMS) is a core area of expertise involving the development and application of special vacuum coating technologies based on the utilization of magnetron gas discharges under the pulsed supply of electrical energy of frequencies from 10 ... 100 kHz. This allows the efficient manufacture of novel layers at high deposition rates. The work focuses on the development of complex integrated process technology and know-how packages (IP) and covers the following areas:

- development and manufacture of key PMS components
- development of PMS processes
- development of layer systems
- integration of processes and equipment for layer analysis
- modeling and simulation of magnetron sources and PMS processes
- plant technology and operator know-how for sputtering plants



Principle of unipolar (top) and bipolar pulsed magnetron sputtering

Applications

- hard, wear resistant coatings on tools, especially for high-speed cutting operations
- new superhard materials for special applications (nanocomposites)
- layers for corrosion protection of parts
- coating of goods in bulk (fasteners for cars and airplanes etc.)
- decorative coatings on three-dimensional parts made of metal, glass, and plastic
- tribological coatings
- functional coatings for medical technology (Ti-based biocompatible and bioactive coatings)
- barrier layers

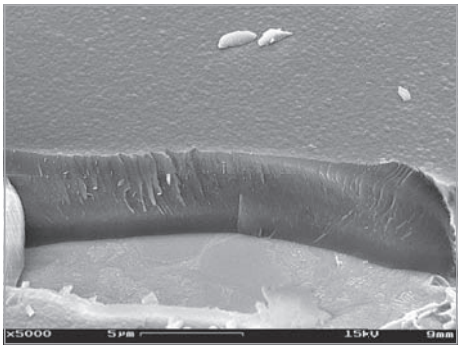
Technical specifications

Sputtering	• DC sputtering • unipolar pulsed sputtering • bipolar pulsed sputtering • pulse package technology
EB evaporation	• high rate EB evaporation • Hollow cathode arc Activated Deposition (HAD) • Magnetron Activated Deposition (MAD)
Plasma pretreatment	• DC etching • pulse plasma pre-treatment • hollow cathode assisted etching

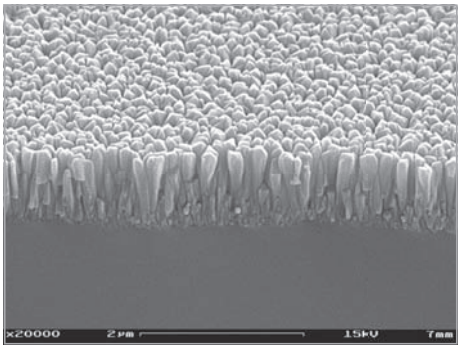
Layers

A great variety of

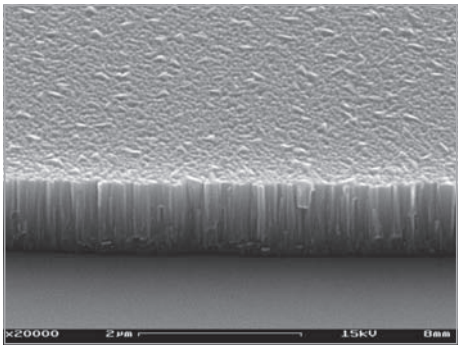
- metals and alloys
- compounds like oxides, nitrides, carbides of Al, Cr, Ti, Zr, Mo, W, …
- gradient layers
- multilayers
- layers with tailored structure (amorphous - crystalline - composite)



Al_2O_3, 4.6 µm, crystalline γ-phase, grain size 15 nm



TiO_2, 1.3 µm, anatase phase, grain size 200 nm



AlN, 1.4 µm, wurtzite phase, grain size 70 nm

Fraunhofer-Institut für Elektronenstrahl- und Plasmatechnik FEP

Winterbergstraße 28
01277 Dresden, Germany

www.fep.fraunhofer.de
info@fep.fraunhofer.de

Dr. Fred Fietzke
fred.fietzke@fep.fraunhofer.de
Phone +49 351 2586-366
Fax +49 351 2586-55-366

Dr. Heidrun Klostermann
heidrun.klostermann@fep.fraunhofer.de
Phone +49 351 2586-367
Fax +49 351 2586-55-367

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