

# Pulse Magnetron Sputtering

## Coating of Components and Tools

### Technologies

Pulse magnetron sputtering (PMS) is our 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 with frequencies from 10 ... 100 kHz. This allows to efficiently manufacture novel layers at high deposition rates. Our work focuses on the development of complex integrated process technology and know-how packages (IP) covering the following areas:

- Development and manufacturing of key PMS components
- Development of PMS processes
- Development of layer systems
- Combination processes with electron beam evaporation and plasma-enhanced CVD
- Sources and PMS processes
- Plant technology and operator know-how for production plants

### 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

### Contact

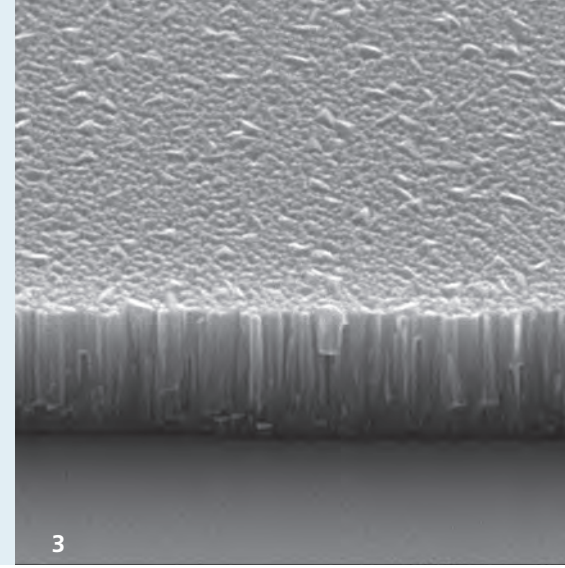
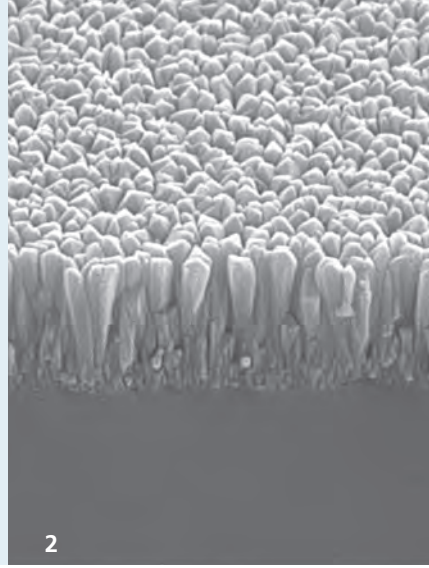
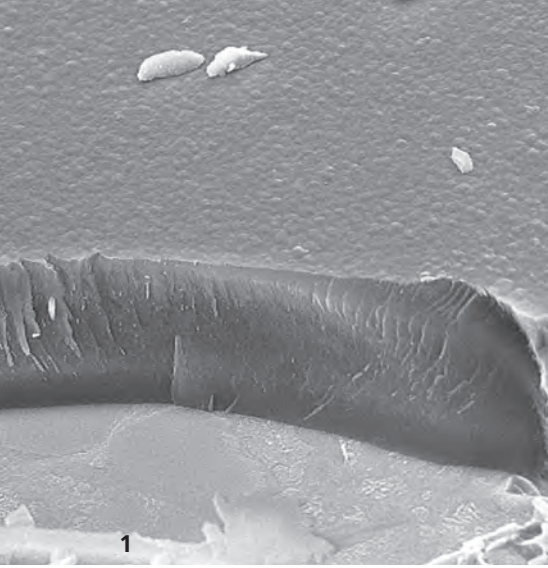
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## Layers

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)
- Barrier layers

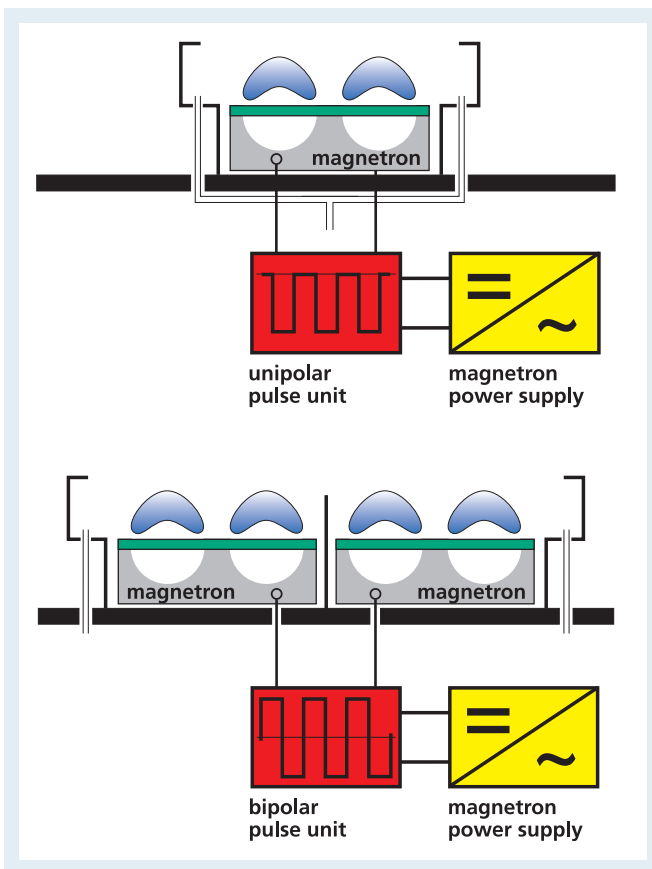
## Technical specifications

Sputtering

Plasma pre-treatment

Process control

- DC sputtering
- Unipolar pulsed sputtering
- Bipolar pulsed sputtering
- HiPIMS
- DC etching
- Pulse plasma pre-treatment
- Hollow cathode assisted etching
- Optical plasma emission
- Partial pressure
- Discharge impedance



Principle of unipolar and bipolar pulsed magnetron sputtering

- 1  $Al_2O_3$ , 4.6  $\mu m$ , crystalline  $\gamma$ -phase, grain size 15 nm, wear-resistant
- 2  $TiO_2$ , 1.3  $\mu m$ , anatase phase, grain size 200 nm, photocatalytic
- 3  $AlN$ , 1.4  $\mu m$ , wurtzite phase, grain size 70 nm, piezoelectric