



COATING OF FLAT SUBSTRATES

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At Fraunhofer FEP we develop industry-oriented processes for applying layers and multilayer systems to large substrates made of glass and polymers. For this we use vacuum-based sputter technologies and high-rate PECVD. Thereby we specialized in pulse magnetron sputtering (PMS) and the control of reactive sputter processes.

We are continually advancing our technologies in order to adapt them to new applications and to optimize the costs for high-quality coatings.

The development of key components for PMS and process control is also offered by Fraunhofer FEP.

The layers and layer systems are used, for example, for architectural glass (low E-coatings / solar control coatings) and for transparent conductive electrodes in photovoltaic and electronic systems. They are also used for electromagnetic shielding and for antireflective (AR) and antireflective-antistatic (ARAS) coatings for displays.



Applications

- optical functional layers:
 - antireflective (AR) / antireflective-antistatic (ARAS)
 - electromagnetic shielding for electronic devices
 - energy-efficient construction (low-E, solar control)
 - mirror layers (highly reflective mirrors, baroque mirror coatings, blue mirrors)
 - decorative layers
- non-optical functional layers:
 - magnetic storage devices
 - anti-scratch layers on polymer surfaces
 - surface metallization
 - hard material layers

Our offer

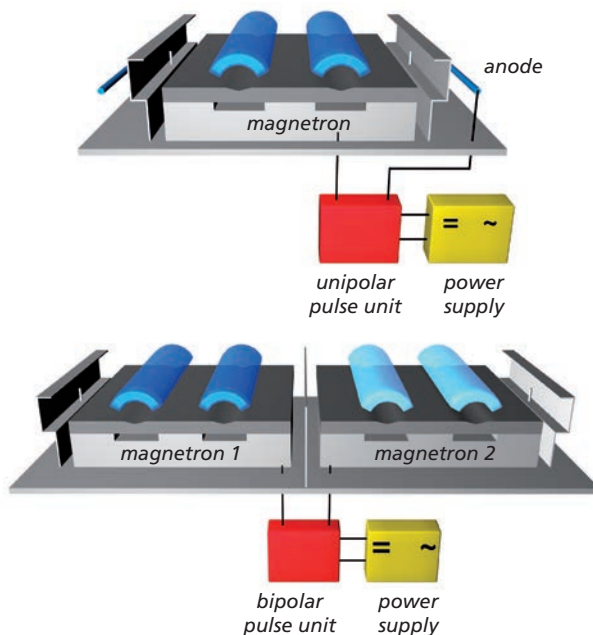
- process development and feasibility studies for new single layers or layer systems having specific electrical, optical, and mechanical properties
- pilot production for the introduction of new products to the marketplace
- development and testing of technological components and integrated packages for production plants
- modernization and expansion of existing sputter plants

Technologies

Layers and layer systems are deposited in reactive mode from metallic targets or from ceramic targets by unipolar or bipolar magnetron sputtering from planar or cylindrical targets. A wide range of materials can be deposited:

| | |
|--------------------------------------|--|
| dielectric materials | Al ₂ O ₃ , Cr ₂ O ₅ , MgO, Nb ₂ O ₅ , SiO ₂ , Si ₃ N ₄ , SnO ₂ , Ta ₂ O ₅ , TiO ₂ , ZnO, ZrO ₂ |
| transparent conductive oxides (TCOs) | ITO, IZO, ZnO based TCOs, TiO ₂ based TCOs |
| metals | Ag, Al, Cr, Cu, Mo, Sn, Ta, Ti, Zr |

Scheme of unipolar and bipolar pulse magnetron sputtering



Typical dynamic deposition rates (DDR) for selected materials:

| | DDR [nm × m/min] |
|--------------------------------|------------------|
| SiO ₂ | 80 |
| TiO ₂ | 40 |
| TiN | 22 |
| Nb ₂ O ₅ | 60 |
| Al ₂ O ₃ | 63 |
| ITO | 50 |
| ZnO | 50 |

- 1 Coated special spectacles
- 2 In-line coating plant ILA 900



We focus on quality and the ISO 9001.