



Fraunhofer Institute for Electron
Beam and Plasma Technology FEP

Roll-to-roll pilot plants

For coatings and converting
using plasma and electron beam technology

Our offer



Strategic fields of research

BIOECONOMY



The combination of a growing global population, climate change, dwindling resources and the loss of agricultural land presents global challenges that can only be overcome by a new understanding of sustainable value creation. This transformation requires us to leave behind economic models based on the exploitation of fossil fuels. Instead, we need to move toward bio-based production, working methods and lifestyles – the bioeconomy.

With its roll-to-roll research activities, Fraunhofer FEP is making a contribution to the research field of bioeconomy. By developing innovative coating technologies, the institute enables the resource-efficient production of functional surfaces that can be used in a variety of applications, such as in the food and packaging industries. Fraunhofer FEP is focussing on the development of coating systems and material combinations that will make climate-damaging materials and the use of rare earths unnecessary in the future. Another focus is on research into biodegradable or recyclable products.

RESOURCE EFFICIENCY & CLIMATE TECHNOLOGIES



The world's natural resources are limited. Yet they are being consumed at ever faster rates by a growing global population. This leads to increasing competition and rising prices, especially for resources such as oil, cobalt and rare earths. At the same time, the extraction of natural resources causes environmental damage such as the release of greenhouse gases, pollution of our air, water and soil, and a decline in biodiversity.

With its roll-to-roll research activities, Fraunhofer FEP promotes the resource-efficient use of environmentally friendly materials for sustainable products. For example, innovative coating solutions for battery technologies increase the efficiency and service life of energy storage systems. We are also developing thermochromic coatings that reduce energy consumption in buildings in the smart building sector by intelligently regulating sunlight. Innovative high-barrier coatings for solar cells and organic photovoltaic solutions also contribute to sustainable product design in the field of climate technologies.

Roll-to-roll pilot plant for sputtering processes and PECVD

coFlex® 600

FOCUS

- Production of optical, electrical or decorative functional layers by sputtering and magnetron PECVD processes
- Development and pilot production of multilayer systems under conditions close to production
- Pre-testing in a separate system on a lower bandwidth is available if required

APPLICATIONS

- Optical coating stacks on flexible substrates (e.g. as thermal barrier coating with high reflection in the infrared spectral range)
- Permeation barrier layers (e.g. for organic photovoltaics)
- Transparent conductive layers (e.g. for flexible solar cells)

ADVANTAGES

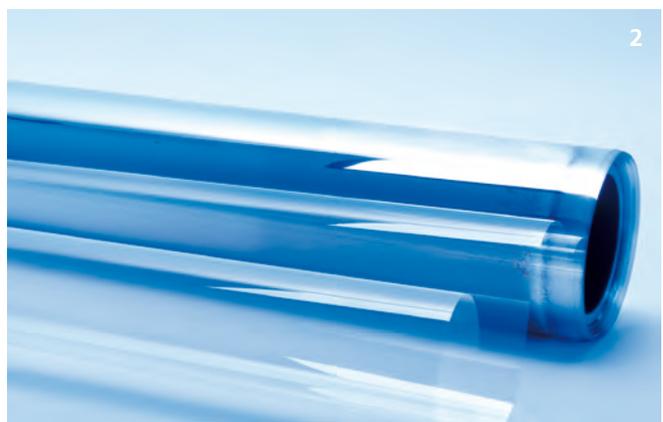
- Highly flexible machine configuration
- Deposition of complex layer systems

TECHNOLOGIES

- Pulse magnetron sputtering:
 - dual magnetron sputtering
 - unipolar magnetron sputtering
 - reactive sputtering
- DC sputtering
- Magnetron PECVD
- Ion-based pre-treatment
- Plasma-based pre-treatment
- In-line measurement
 - optical transmission and reflection
 - sheet resistance
- Advanced off-line metrology

TECHNICAL DATA

Coating width	≤ 600 mm
Web width	650 mm
Web thickness	7 ... 200 µm
Max. roll diameter	400 mm
Web speed	0.1 ... 100 m/min
Process modules	<ul style="list-style-type: none">■ Dual magnetron sputter systems (DMS systems)■ Single magnetron sputter systems (SMS systems)■ Ion source
Material/substrates	Metals, TiO ₂ , SiO ₂ , Nb ₂ O ₅ , ITO, ZnO, SnO ₂ , HfO ₂ , WO ₃ , TiN, Si ₃ N ₄ , ZrO ₂



Roll-to-roll pilot plant for plasma assisted high-rate deposition

novoflex® 600

FOCUS

- Combination of vacuum coating technologies
- Coating of polymer films with different coating materials in a flexible sequence
- Pre-testing possible on separate plant

APPLICATIONS

- Barrier layers for packaging films
- Coatings for special applications, such as:
 - transparent conductive electrodes
 - high barrier layers for flexible electronics
 - electrode layers for batteries

ADVANTAGES

- High coating rates
- In-situ measuring of optical and electrical properties

TECHNOLOGIES

- In-line plasma pre-treatment
- Plasma-activated high-rate deposition
- Pulse magnetron sputtering (PMS)
- Magnetron PECVD (magPECVD)
- Thermal evaporation
- Electron beam evaporation
- In-situ measurement
- Hollow cathode arc PECVD (arcPECVD)

TECHNICAL DATA

Coating width	≤ 600 mm
Web width	620 mm
Web thickness	Plastic films (3 ... 250 µm), other flexible substrates, e. g. textiles up to 6 mm
Max. roll diameter	500 mm
Web speed	0.1 ... 600 m/min
Process modules	<ul style="list-style-type: none">■ Pre-treatment using an ion source■ 5 coating chambers, all differentially pumped (pressure difference up to a factor of 30), Simultaneous coating with up to 5 in-line processes<ul style="list-style-type: none">– 2 evaporation chambers for boat and/or electron beam evaporation– 3 chambers for reactive pulse magnetron sputtering (PMS)■ In-situ measurement technology
Material/substrates	Polymer films, flexible metal foils, other flexible substrates, e. g. textiles



Roll-to-roll pilot plant for slot die coating and electron beam curing

atmoFlex 1250

FOCUS

- Production of optical and decorative functional coatings as well as scratch-resistant coatings
- Realization of textured layers through imprint processes
- Lamination of web material

APPLICATIONS

- Optical and decorative functional layers
- Coatings textured by imprint processes
- Scratch and wear protection coatings
- Permeation barrier coatings

ADVANTAGES

- Energy-efficient electron beam technology
- Crosslinking of lacquers without complex thermal dryer sections and without thermal substrate stress
- Use of lacquers without photoinitiators and solvents
- Technology testing from DIN A4 substrate size up to > 1,000 linear metres @ 1250 mm width

TECHNOLOGIES

- Nano- and micro-imprinting
- Contactless slot-die coating
- Lamination
- Electron beam crosslinking at atmospheric pressure
- Electron beam treatment
- In-line pre-treatment/contact cleaning

TECHNICAL DATA

Coating width	≤ 1200 mm	
Web width	1250 mm	
Web thickness	10 ... 300 µm, other flexible materials (membranes, textiles, etc.) up to 2 mm	
Max. roll diameter	500 mm	
Web speed	1 ... 150 m/min	
Process modules	<ul style="list-style-type: none"> ■ Unwinder with protective film handling ■ Corona pre-treatment ■ Contact cleaning ■ Slot-die coating ■ Wet lamination 	<ul style="list-style-type: none"> ■ Cross-linking / treatment with electron beam ■ Cold lamination ■ Rewinder with protective film handling ■ Nano- and micro-imprinting ■ Edge trimming and film cutting
Material/substrates	Polymer films, paper, membranes, textiles, metal foils	



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