



# Polymer materials and membrane technology

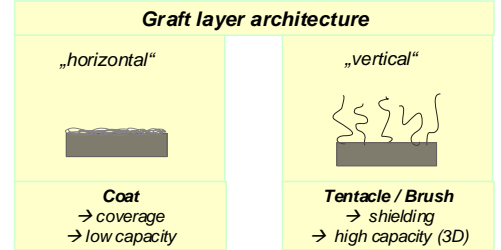
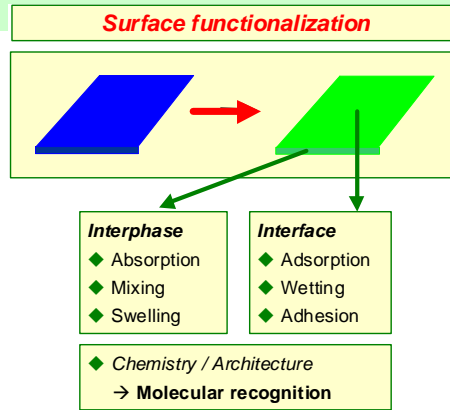
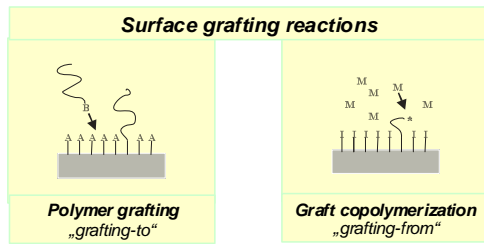
Research group of Prof. Dr. Mathias Ulbricht

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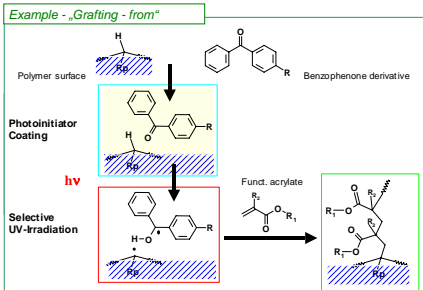
## Profile

The main research activities are devoted to **functional polymer materials** with a particular focus onto **molecularly imprinted polymers (MIPs)** and **synthetic membranes**, especially composite membranes. Synthesis or manufacturing of MIPs and composite membranes is in most cases done via **controlled surface functionalizations**. Besides detailed investigations of the chemistry, also potential **manufacturing technologies** are evaluated. The function of the novel „bio-inspired“ or „smart“ materials is studied in the context of analytics, separation as well as integrated technical processes, including microseparators and –reactors for „lab-on-a-chip“ systems, with a clear focus onto potential **application technologies** in the LifeSciences. Furthermore, **membrane technologies and processes** are also evaluated with respect to other industrial applications.

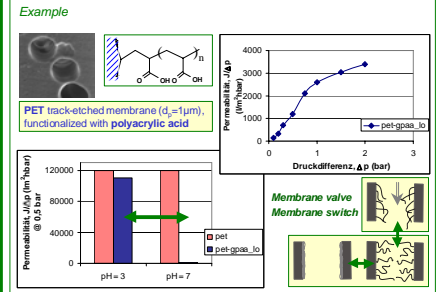
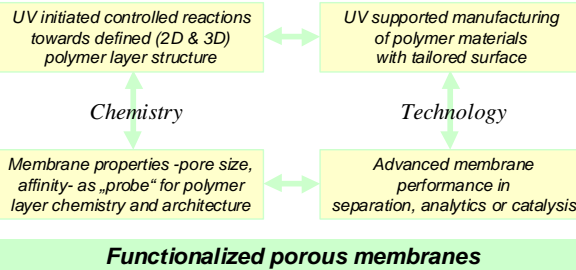
## Context / Background



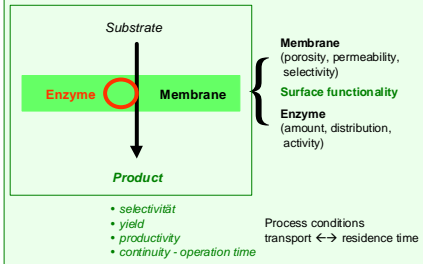
## Focus



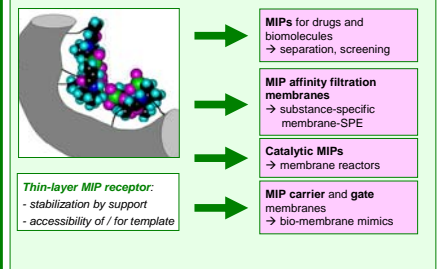
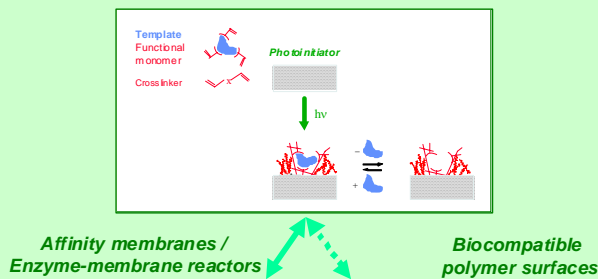
## Photo reactions for surface functionalization



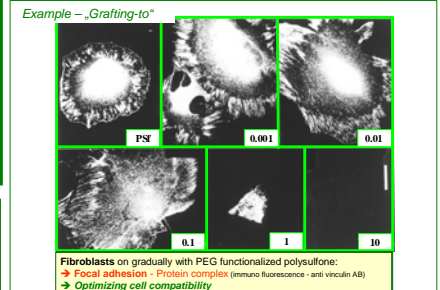
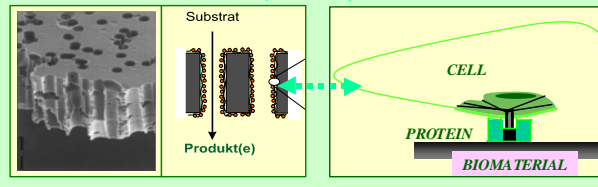
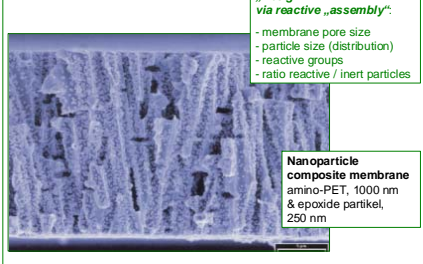
## Enzyme-membrane reactor



## Molecularly imprinted polymers (MIPs) - Thin-layer MIPs



## Example Novel membrane architecture



## Current projects (Ph.D. or PostDoc)

- Molecularly imprinted polymer blend membranes via phase inversion
- Porous MIP particles and membranes for solid phase extraction
- Molecularly imprinted „fixed carrier“ and „gate“ membranes
- Catalytically active MIP membranes
- Tailored „tentacle“ graftcopolymer layers for protein affinity assays and sensors
- Polymer surfaces with optimized biocompatibility via grafting of hydrophilic macromolecules
- Membranes with optimal pore size and charge for electrokinetically controlled separations
- Membranes for the fractionation of drug extracts from plants
- Minimizing membrane fouling via „smart“ surface functionalization

## Main instrumentation and methods

### General analytics

- HPLC system with autosampler, UV-Vis diode array and RI detectors
- FPLC system „ÄKTA Purifier“
- Fluorescence spectrophotometer with microplate reader
- UV-Vis spectrophotometer
- UV-Vis microplate reader
- Amino acid analyzer
- Porometer (BET, etc.)

### Surface analytics

- Contact angle measurement
- Surface plasmon resonance (SPR)
- Tangential streaming potential (zetapotential)

### Membrane characterization

- Permporometer
- Micro-, Ultra- and Nanofiltration
- Reverse osmosis
- Gas or vapour permeation and separation
- Gas and liquid diffusion
- Transmembrane streaming potential (zetapotential)

### Surface functionalization

- Photolithography UV irradiation system
- other UV irradiation systems and reactors

## Planned projects

- Molecularly imprinted polymer layers with high affinity for biomacromolecules
- Controlled protein hydrolysis in an enzyme-membrane reactor
- Nanoparticle composite membranes
- Composite membranes for nanofiltration
- Membrane switches and valves for microseparators and -reactors
- ...

## Contact:

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