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Characterization of Hybrid Materials Designed via Photo-Induced Ligation Chemistries

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Introduction

Experimental

•X-ray Photoelectron Spectroscopy (XPS):

The current work presents different photochemical reactions which allow the grafting of various (natural and artificial) polymeric structures onto a diverse set of surfaces in a spatially controlled manner.

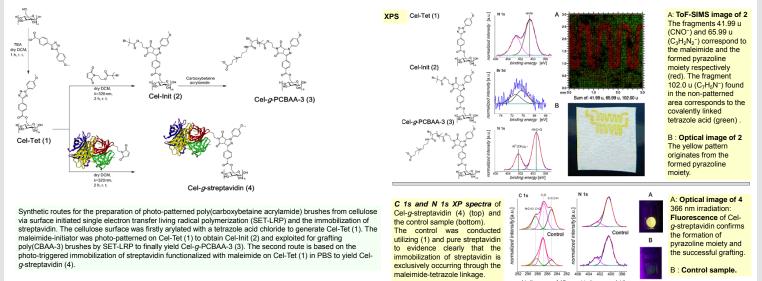
ThermoFisher Scientific K-Alpha Spectrometer

•Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS) ION-TOF GmbH ToF.SIMS⁵ Spectrometer

Photo-Patterning of Non-Fouling Polymers and Biomolecules on Paper^[1]

We focus on the synthesis and in depth characterization of the newly generated hybrid materials, thereby providing the technological base for a novel avenue for the development of biosensing materials as well as bioactive, non-fouling, flexible and inexpensive surfaces based on cellulose substrates.^[1]

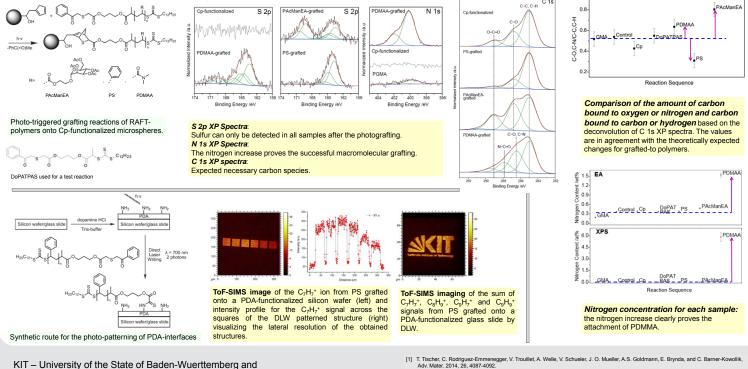
By employing nitrile imine-mediated tetrazole-ene cycloaddition (NITEC), streptavidin was grafted onto cellulose whereas non-fouling poly(carboxybetaine acrylamide) brushes were generated in a graftingfrom approach, where the initiator was previously attached via NITEC. This leads to spatially-resolved functionalization of paper with both non-fouling polymer brushes as well as functional protein entities. Streptavidin is photo-immobilized with remarkable efficiency, opening the possibility to generate new materials for biomedical applications.



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Photo-Induced Functionalization of Spherical and Planar Surfaces via Caged Thioaldehyde End-Functional Polymers^[2]

The present work shows the combination of the light-induced thioaldehyde ligation reaction with reversible addition-fragmentation chain transfer (RAFT) polymerization,^[2] thus enabling the photo-induced grafting of any polymer synthesizable via RAFT onto surfaces carrying a nucleophilic motif or diene species, such as a carrier material coated with a poly(dopamine) (PDA) layer or porous cyclopentadienefunctionalized microspheres. By combination with a Direct Laser Writing (DLW) setup, any two-dimensional pattern can be encoded onto PDA-coated surfaces with micrometer resolution. Precision functionalized microspheres have a wide range of applications from pharmaceuticals and chromatography to organic synthesis



National Research Center of the Helmholtz Association

T. Tischer, C. Rodriguez-Emmenegger, V. Trouillet, A. Welle, V. Schueler, J. O. Mueller, A.S. Goldmann, E. Brynda, and C. Barner-Kowollik, Adv. Mater. 2014, 26, 4087-4092.
M. Kaupp, A.S. Quick, C. Rodriguez-Emmenegger, A. Welle, V. Trouillet, O.Pop-Georgievski, M. Wegener, and C. Barner-Kowollik, Adv. Funct. Mater. 2014, 24, 5649–5661