

Visible Light-Responsive Amphiphilic Polymer Conetworks Based on DASA Photoswitches

Sebastian Erich Ulrich

The incorporation of visible light-responsive organic photoswitches into polymers allows the creation of light-responsive materials that can be controlled with high spatial and temporal precision without the use of hazardous UV light.

To achieve visible light-responsive polymers, a modular conjugation method for 2nd generation donor-acceptor Stenhouse adducts (DASAs), a novel type of organic photoswitches with negative photochromism, was developed. The conjugation of different DASAs to a range of (meth)acrylate copolymers allowed the investigation of the matrix influence on DASA photoswitching as well as wavelength-specific multi-color photopatterning of thin polymer films. Moreover, application to amphiphilic block copolymers and self-assembly into the hydrophobic shell of polymersomes enabled the creation of visible light-responsive enzyme nanoreactors cascades with wavelength-specific activation.

An active ester-based functionalization strategy for amphiphilic polymer conetworks (APCNs) was developed that allows their functionalization over a wide range up to entirely poly(*N*-alkyl acrylamide)-based APCNs. While modification of APCNs with DASAs was possible, currently available DASAs do not function in the protic environment of the APCN's hydrophilic phase. To achieve visible light-responsive DASA polymer networks, additional DASA conjugation methods were developed based on thiol-ene click and hydrosilylation chemistry. The former enabled the fabrication of structured DASA networks by 2-photon photolithography.

Jury:

Prof. Barbara Rothen-Rutishauser (president of the jury)

Prof. Jörg Tiller (external co-examiner)

Prof. Christoph Weder (internal co-examiner)

Dr. Luciano F. Boesel (external ca-advisor)

Prof. Nico Bruns (thesis advisor)