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Jena, 26. Oktober 2018

EINLADUNG

Am Dienstag, **20. November 2018**, spricht um **14:00 Uhr**
im Hörsaal des ZAF, Philosophenweg 7, 07743 Jena

Herr Dr. Bernhard V. K. J. Schmidt

MPI of Colloid- and Interfaces
Potsdam/Golm

zum Thema

***“Double hydrophilic block copolymer self-assembly and Carbon
Nitride-derived hydrogels”***

Alle Interessenten sind herzlich eingeladen.

gez. Prof. Dr. Ulrich S. Schubert

Es handelt sich um eine Veranstaltung des SFB 1278 - POLYTARGET

Double hydrophilic block copolymer self-assembly and Carbon Nitride-derived hydrogels

Dr. Bernhard V.K.J. Schmidt
Max Planck Institute of Colloids and Interfaces

Water-soluble polymers and hydrogels play a crucial role in contemporary polymer science. There are several promising applications proposed for these materials, especially in the biomedical field. Thus, applications like drug-delivery, sensing or tissue engineering are in the focus of research.

In the present contribution self-assembly of completely hydrophilic block copolymers in water is shown. Double hydrophilic block copolymers (DHBCs) are utilized that do not show changes in water solubility in the observed temperature and pH range. The self-assemblies are formed due to the hydrophilic effect, which allows the formation of nano- to micro-scale aggregates in aqueous solution although completely water-soluble blocks are employed. The self-assemblies are formed due to differences in the hydrophilicity of the blocks and their affinity to water. To facilitate future biomedical applications, biocompatible blocks are utilized, e.g. poly(*N*-vinylpyrrolidone),¹ poly(2-ethyl-2-oxazoline)² or poly(saccharides).^{4,5} Due to the complete hydrophilic nature of the formed structures significant different permeability compared to traditional amphiphilic systems is expected. Moreover, the utilization of DHBCs in the synthesis of metal-organic mesocrystals will be discussed.⁵ In such a way, crystal growth can be modulated to obtain unprecedented metal-organic polymer composites with remarkable morphologies.

Another important type of polymer materials are hydrogels that have promising applications, e.g. in the field of tissue engineering. Recently, we explored the formation of hydrogels via graphitic Carbon Nitride (g-CN) initiated photopolymerization. Therefore, hydrogels can be formed via irradiation with visible light at ambient conditions. At the same time, g-CN acts as a reinforcer due to its sheet like morphology and its ability to act as crosslinker. Thus, hydrogels with high storage moduli are obtained (e.g. from 8-800 kPa at 0.1% strain) in a convenient one step procedure.^{6,7} Moreover, the mechanical properties can be tailored via g-CN type and incorporated amount.

In summary, a new concept of block copolymer self-assembly based on completely water-soluble and biocompatible polymers will be presented. Moreover, a novel photoinitiator system for formation of reinforced hydrogels will be introduced.

- 1) Jochen Willersinn, Bernhard V. K. J. Schmidt, *Polym. Chem.* **2018**, 9 (13), 1626-1637.
- 2) Jochen Willersinn, Bernhard V. K. J. Schmidt, *Polymers* **2017**, 9 (7), 293.
- 3) Jochen Willersinn, Anna Bogomolova, Marc Brunet Cabré, Bernhard V. K. J. Schmidt, *Polym. Chem.* **2017**, 8, 1244-1254.
- 4) Noah Al-Nakeeb, Jochen Willersinn, Bernhard V. K. J. Schmidt, *Biomacromolecules* **2017**, 18 (11), 3695-3705.
- 5) Jongkook Hwang, Tobias Heil, Markus Antonietti, Bernhard V. K. J. Schmidt, *J. Am. Chem. Soc.* **2018**, 140 (8), 2947-2956.
- 6) Baris Kumru, Menny Shalom, Markus Antonietti, Bernhard V. K. J. Schmidt, *Macromolecules* **2017**, 50 (5), 1862-1869.
- 7) Baris Kumru, Valerio Molinari, Menny Shalom, Markus Antonietti, Bernhard V.K.J. Schmidt, *Soft Matter* **2018**, 14 (14), 2655-2664.

Dr. Bernhard V. K. J. Schmidt: Curriculum Vitae

Work Experience:

- 01/2015 – present **Group Leader** (department of Prof. Markus Antonietti)
MPI of Colloid- and Interfaces Potsdam/Golm
- 11/2013 – 12/2014 **Post Doc** (group of Prof. Craig J. Hawker)
University of California Santa Barbara
- 06/2010 - 07/2013 **Ph.D. Studies** (group of Prof. Christopher Barner-Kowollik)
Karlsruhe Institute of Technology
- 10/2009 – 03/2010 **Internship** (group of Dr. habil. Jean-François Lutz)
Fraunhofer Institute for Applied Polymer Research Potsdam/Golm
- 10/2004 - 09/2009 **Studies of Chemistry**
Technical University Darmstadt



Awards:

Dr. Hermann-Schnell Fellowship, Post Doc Fellowship of the German Academic Exchange Service (DAAD), Springer Theses Award, Anton-Keller-Award (Technical University Darmstadt)

Fields of research:

- Double hydrophilic block copolymer (DHBC) self-assembly
- Metal-organic frameworks (MOFs) as polymerization templates and catalysts
- Graphitic Carbon Nitride (g-CN) based polymer materials

Top Publications:

- Bernhard V. K. J. Schmidt, Nina Fechner, Jana Falkenhagen, Jean-François Lutz:* Controlled folding of synthetic polymer chains through the formation of positionable covalent bridges, *Nature Chemistry* **2011**, 3 (3), 234-238.
- Jongkook Hwang, Tobias Heil, Markus Antonietti, Bernhard V. K. J. Schmidt:* Morphogenesis of Metal-Organic Mesocrystals Mediated by via Double Hydrophilic Block Copolymers, *Journal of the American Chemical Society* **2018**, 140 (8), 2947-2956.
- Noah Al-Nakeeb, Jochen Willersinn, Bernhard V. K. J. Schmidt:* Self-Assembly Behavior and Biocompatible Crosslinking of Double Hydrophilic Linear-Brush Block Copolymers, *Biomacromolecules* **2017**, 18 (11), 3695-3705.
- Baris Kumru, Menny Shalom,* Markus Antonietti, Bernhard V.K.J. Schmidt:* Responsive and Reinforced Hydrogels via Carbon-Nitride Initiated Polymerization, *Macromolecules* **2017**, 50 (5), 1862-1869.
- Hui-Chun Lee, Marco Fantin, Markus Antonietti,* Krzysztof Matyjaszewski,* Bernhard V. K. J. Schmidt:* Synergic Effect between Nucleophilic Monomers and Cu(II)-Metal-Organic Framework for Visible Light-Triggered Controlled Photopolymerization, *Chemistry of Materials* **2017**, 29 (21), 9445–9455.

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