

Department of Chemistry

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Professor Wilhelm Huck

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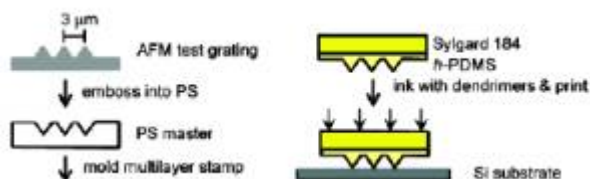
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Nanotechnology - Control over polymers at the nanometer level

The overall research interest of my group is the use of polymers as building blocks in nanotechnology. State-of-the-art lithography techniques like focused ion beam, e-beam or extreme UV lithography are able to generate patterns in the sub-100 nm region. However, these techniques have their limitations in terms of materials that can be patterned and the high costs of investment in equipment. Alternative techniques based on self-assembly and self-organization of organic and inorganic particles into well-defined regular nanostructures are therefore highly desirable. Polymers could be ideal building blocks for such approaches because of their natural 5-100 nm lengthscale, ease of synthesis, and rich chemistry. Currently, it is impossible to design and fabricate arbitrary polymers with well-defined shape and functionality. If we are to bridge the gap between the biological world and nanofabrication, major advances in the control over polymeric materials at the nanometer level are necessary. As a result of recent progress in controlling lengthscales of polymer materials at the nanometer level, we are starting to explore the effects of nanoconfinement on phase-separation, glass transition temperature, conductivity, and optical properties, in a variety of polymer systems.



The tools we are developing:

Nanocontact printing
 Micro and nanoembossing
 Controlled phase separation of block copolymers

Fields of potential applications:

Polymer electronics
 Nanoscale electronic and biological devices
 Optoelectronic devices
 Growth of polymer brushes

Selected Publications

Edmondson, S.; Huck, W. T. S. Quasi-2D Polymer Objects From Patterned, Cross-linked Polymer Brushes *Adv. Mater.* **2004**, 16, 1327-1331

Wang, J. Z.; Zheng, Z. H.; Li, H. W.; Huck, W. T. S.; Sirringhaus, H. Dewetting of conducting polymer inkjet droplets on patterned surfaces, *Nature Materials*, **2004**, 3, 171-176

Sullivan, T. P.; van Poll, M. L.; Dankers, P. Y. W.; Huck, W. T. S. Forced peptide synthesis in nanoscale confinement under elastomeric stamps, *Angew. Chem. Int. Ed.* **2004**, 43, 4190-4193

Yang, Z., Huck, W.T.S., Clarke, S.M., Tajabkhsh, A.R., Terentjev, E.M. Shape-Memory Nanoparticles from Inherently Nonspherical Polymer Colloids, *Nature Materials*, **2005**, 4, 486-490

External Links:

Publications

Structure and Collapse of a Surface-Grown Strong Polyelectrolyte Brush on Sapphire

IE Dunlop, RK Thomas, S Titmus, V Osborne, S Edmondson, WTS Huck, J Klein - *Langmuir* (2012) 28, 3187
 (DOI: [10.1021/la204655h](http://dx.doi.org/10.1021/la204655h) (<http://dx.doi.org/10.1021/la204655h>))

Oligomeric Compatibilizers for Control of phase Separation in Conjugated Polymer Blend Films

JE Slota, E Elmalem, GL Tu, B Watts, JF Fang, PM Oberhumer, RH Friend, WTS Huck - *Macromolecules* (2012) 45, 1468
 (DOI: [10.1021/ma201523m](http://dx.doi.org/10.1021/ma201523m) (<http://dx.doi.org/10.1021/ma201523m>))

Single Molecule Fluorescence under Conditions of Fast Flow

MH Horrocks, H Li, JU Shim, RT Ranasinghe, RW Clarke, WT Huck, C Abell, D Klenerman - *Anal Chem* (2012) 84, 179
 (DOI: [10.1021/ac202313d](http://dx.doi.org/10.1021/ac202313d) (<http://dx.doi.org/10.1021/ac202313d>))

On the role of single regiodefects and polydispersity in regioregular poly(3-hexylthiophene): Defect distribution, synthesis of defect-free chains, and a simple model for the determination of crystallinity

P Kohn, S Huettner, H Komber, V Senkovskyy, R Tkachov, A Kiriy, RH Friend, U Steiner, WTS Huck, J-U Sommer, M Sommer - Journal of the American Chemical Society (2012) 134, 4790

Microfluidic platform for combinatorial synthesis in picolitre droplets

AB Theberge, E Mayot, A El Harrak, F Kleinschmidt, WTS Huck, AD Griffiths - Lab on a Chip - Miniaturisation for Chemistry and Biology (2012) 12, 1320

(DOI: [10.1039/c2lc21019c](http://dx.doi.org/10.1039/c2lc21019c) (<http://dx.doi.org/10.1039/c2lc21019c>))

Influence of Side Chains on Geminate and Bimolecular Recombination in Organic Solar Cells

S Massip, PM Oberhumer, G Tu, S Albert-Seifried, WTS Huck, RH Friend, NC Greenham - Journal of Physical Chemistry C (2011) 115, 25046

(DOI: [10.1021/jp2070584](http://dx.doi.org/10.1021/jp2070584) (<http://dx.doi.org/10.1021/jp2070584>))

Chain-growth polymerization of unusual anion-radical monomers based on naphthalene diimide: A new route to well defined n-type conjugated copolymers

V Senkovskyy, R Tkachov, H Komber, M Sommer, M Heuken, B Voit, WTS Huck, V Kataev, A Petr, A Kiriy - Journal of the American Chemical Society (2011) 133, 19966

(DOI: [10.1021/ja208710x](http://dx.doi.org/10.1021/ja208710x) (<http://dx.doi.org/10.1021/ja208710x>))

Ring Walking versus Trapping of Nickel(0) during Kumada Catalyst Transfer Polycondensation Using Externally Initiated Electron-Accepting Thiophene-Benzothiadiazole-Thiophene Precursors

H Komber, V Senkovskyy, R Tkachov, K Johnson, A Kiriy, WTS Huck, M Sommer - Macromolecules (2011) 44, 9164

(DOI: [10.1021/ma2018827](http://dx.doi.org/10.1021/ma2018827) (<http://dx.doi.org/10.1021/ma2018827>))

Chain-growth suzuki polymerization of n-type fluorene copolymers

E Elmaleh, A Kiriy, WTS Huck - Macromolecules (2011) 44, 9057

(DOI: [10.1021/ma201934q](http://dx.doi.org/10.1021/ma201934q) (<http://dx.doi.org/10.1021/ma201934q>))

Effect of polymer brush architecture on antibiofouling properties

G Gunkel, M Weinhart, T Becherer, R Haag, WTS Huck - Biomacromolecules (2011) 12, 4169

(DOI: [10.1021/bm200943m](http://dx.doi.org/10.1021/bm200943m) (<http://dx.doi.org/10.1021/bm200943m>))

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