
COLLOQUIUM

From Polymer Brushes to Messenger Materials and Sustainable Metasurfaces

Speaker:

Prof. Dr Andreas Fery, is head of the Division for Physical Chemistry and Polymer Physics at the Leibniz-Institut für Polymerforschung Dresden since 2015. His research interests are in Polymer science and Colloid and interface science with an emphasis on soft functional materials and sustainability. He is coordinating the Leibniz Research Alliance “Advanced Materials Safety” and is also deputy spokesperson of the cluster of excellence “Responsible electronics in the climate change era”.

Time:

Tuesday, November 26, 2026 – 1 pm

Venue:

ISAS Campus, Lecture Hall
Otto-Hahn-Straße 6b
44227 Dortmund

&

WebEx: <https://t1p.de/tialu>

Meeting-ID: 2785 459 0227

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Abstract

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Polymer surface modification offers unique possibilities for creating interactive and functional materials. Polymer brushes in particular can be employed for nanoscale control both on macroscopic surfaces and for nanoparticles and I will discuss the implications for self-reporting surfaces and metamaterials.

Polymer brush surfaces that alter their physical properties in response to chemical stimuli have the capacity to be used as so called Messenger materials. These materials translate local physicochemical changes into spatially-resolved modulation of fluorescence [1]. This approach can be used for unraveling contact mechanics and friction in complex scenarios as well as clarify mechanisms acting in responsive and adaptive surface coatings.

Polymer modification of nanoparticles results in hairy nanoparticles, which find a range of applications in functional materials [2]. Especially metallic nanoparticles offer a number of interesting optical and electronic effects due to their localized surface plasmon resonance (LSPR) Adding a functional polymeric shell does not only allow controlling inter-particle distances but as well tailor transport / electronic coupling. [2,3] Increasing the level of complexity, the ordering of particles at different length scales opens another powerful routes to optical and electronic functionality due to novel

collective plasmonic excitations arising from plasmonic coupling effects. We focus on achieving such ordered particle arrays through self-assembly approaches. Colloidal self-assembly can indeed yield well-defined colloidal clusters and surface arrays in which coupling effects can be controlled. In particular, large-scale assemblies are possible in combination with biomimetic surface patterning like controlled wrinkling. We discuss the underlying physicochemical principles of the structure formation process and the resulting plasmonic coupling effects including chiroplasmonic metamaterial effects [4,5]. Finally, we present perspectives on how these assembly principles can be relevant for developing circular economy approaches for advanced materials.

Keywords: polymer brushes, messenger materials, plasmonics, circular dichroism, metamaterials, particle based materials, circular materials

References

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