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Intelligent Polymer Materials and Films for Electrochemical, Pharmaceutical & Soft Robotics Applications

Monday, 5 December 2022 16:00 (2 hours)

This poster will give insights into current research activities of the Ludwigs team. In our interdisciplinary and international research team of polymer chemists, physical chemists and materials scientists we are developing functional and intelligent polymer materials and devices for electrochemical, pharmaceutical and soft robotics applications. One of our aims is to control and manipulate structure-function relationships of hierarchical architectures from the molecular via the nanoscopic to the macroscopic scale such as block copolymer self-assembly and controlled crystallization of semicrystalline polymers.
Going beyond structure-function relationships stimuli-responsive polymers have come in the interest of our research, because their properties show a response when triggered by external environmental conditions such as change in relative humidity, temperature or electric fields, exhibiting great potential for the development of smart devices.
Conjugated (e.g. polythiophenes) and redox polymer (e.g. carbazole-bearing polymer) films are studied in terms of their electrochemical doping behavior [1,2] and with respect to electrochemical switching and doping between different redox states, e.g. for electrochromism or pore control in block copolymer templates.
In a recent paper, the mechanical properties of bilayer actuators as a function of relative humidity were examined in detail in collaboration with the group of Prof. Holger Steeb. By fabricating a bilayer out of a hydrophobic and a hydrophilic polymer (PDMS and PEDOT:PSS, respectively), our group managed to create a humidity-triggered actuator. Due to the fact that the mechanical properties of PEDOT:PSS depend strongly on the relative humidity (r.H.), it was possible to predict the curvature of the humidity-triggered bilayer actuators by the humidity-dependence of the mechanical properties. [3]

References

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(3) C. Dingler, H. Müller, M. Wieland, D. Fauser, H. Steeb, S. Ludwigs, Adv. Mater., 2021, 33, 2007982.

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