DF 12: Optical and Nonlinear Optical Properties I (DF with CPP)

Time: Wednesday 9:30–11:00 Location: EB 407

Invited Talk DF 12.1 Wed 9:30 EB 407

Holographic microstructuring of liquid-crystalline elastomers — •Irena Drevensek-Olenik[1,2], Martin Čopič[1,2], Martin Fally[3], Valentina Domenici[4], and Antoni Sánchez-Ferrer[5] — [1]Faculty of Mathematics and Physics, University of Ljubljana, Jadranska 19, SI1000 Ljubljana, Slovenia — [2]J. Stefan Institute, Jamova 39, SI1000 Ljubljana, Slovenia — [3]Faculty of Physics, University of Vienna, Boltzmanngasse 5, A-1090 Wien, Austria — [4]Dipartimento di Chimica e Chimica Industriale, Università degli studi di Pisa, via Risorgimento, 35, 56126 Pisa, Italy — [5]Department of Health Sciences and Technology, ETH Zurich, Schmelzbergstrasse 9, 8091 Zurich, Switzerland

Adding a small amount of photoactive component, for instance a photo-isomerizable azobenzene derivative, to the matrix of a liquid-crystalline elastomer (LCE) opens up various possibilities for optical manipulation of mechanical, thermal, electrical and optical properties of the material. Holographic microstructuring in LCEs is based on the coupling between isomerization state of the azobenzene groups and orientational order of the mesogenic side chains. Due to collective nature of this process light-induced spatial modifications of optical refractive index in LCEs are several magnitudes larger than in conventional azobenzene-based holographic media. Holographic patterning of LCEs consequently provides a very convenient method for fabrication of tuneable optical diffraction structures that can easily be manipulated by external stimuli, such as strain, external fields and temperature variations.

DF 12.2 Wed 10:00 EB 407

Random-Cavity Lasing from Electrospun Polymer Fiber Networks — •Sarah Krämmer[1], Christoph Vannahme[2], Cameron L. C. Smith[2], Tobias Grossmann[1], Michael Jenne[1], Stefan Schierle[1], Minh Tran[1], Lars Jørgensen[3], Ioannis S. Chronakis[3], Anders Kristensen[2], and Heinz Kalt[1] — [1]Institute of Applied Physics, Karlsruhe Institute of Technology (KIT), Germany — [2]Department of Micro- and Nanotechnology, Technical University of Denmark (DTU), Denmark — [3]DTU-Food, DTU, Denmark

Electrospinning is a versatile, simple, low-cost and high-throughput technique for the fabrication of fibers and fiber networks with fiber diameters in the micro- and nanometer range. The resulting high surface-to-volume ratio makes the fibers excellent candidates for sensing, tissue-growth and filtering. In the field of photonics they serve as waveguides and light sources when doped with an emitter. We report on the lasing emission from random cavities formed in networks of electrospun dye-doped polymer fibers. Spatially resolved spectroscopy and spectral analysis prove that the observed laser emission originates from individual ring resonators randomly distributed throughout the network. Preliminary measurements show the suitablity of the fiber networks as gas sensors where the spectral position of a lasing mode serves as transducer.

DF 12.3 Wed 10:20 EB 407

Whispering Gallery Modes in Single Copolymer Microspheres — •Daniel Braam[1], Kenichi Tabata[2], Soh Kushida[2], Robert Niemöller[1], Günther M. Prinz[1], Yohei Yamamoto[2], and Axel Lorke[1] — [1]Faculty of Physics and CENIDE, University of Duisburg-Essen, Lotharstraße 1, 47057 Duisburg, Germany — [2]Faculty of Pure and Applied Sciences, University of Tsukuba, 1-1-1 Tennodai, Tsukuba, Ibaraki 305-8573, Japan

Copolymers are promising candidates for use in optoelectronic devices due to their low fabrication cost and high emission efficiency. Here we investigate several π-conjugated alternating copolymers, which combine the advantages of being a dye, a dielectric and a self-assembled resonator, as they form nearly perfect spheres when precipitated from solution. Excitation leads to standing waves inside these microspheres, known as whispering gallery modes (WGMs). Their spectral position, number and line width is dependent on the sphere diameter. The measurements, showing both TM- and TE-modes, are in good agreement with model calculations [1]. The relative amplitude of the modes is strongly dependent on the sphere's excitation spot, revealing leakage of polar modes to the substrate, while equatorial modes sustain. During continuous illumination we observe lifting of degeneracy of the WGMs, followed by slow deterioration. Covering the spheres with a thin layer of titanium leads to an improved resistance against irradiation damage.

[1] Tabata, K., Braam, D. *et al.* Self-assembled conjugated polymer spheres as fluorescent microresonators. Sci. Rep. **4**, 5902; DOI:10.1038/srep05902 (2014).

DF 12.4 Wed 10:40 EB 407

TiO_2 coated Whispering Gallery Mode (WGM) Resonators for Label-free Biosensing — •Fabian Ruf[1], Sarah Krämmer[1], Christoph Vannahme[2], Antonina Vigovskaya[3], Ljiljana Fruk[3], Anders Kristensen[2], and Heinz Kalt[1] — [1]Institute of Applied Physics, Karlsruhe Institute of Technology (KIT), Germany — [2]Department of Micro- and Nanotechnology, Technical University of Denmark (DTU), Denmark — [3]DFG-Centre for Functional Nanostructures CFN, Karlsruhe Institute of Technology (KIT), Germany

Biosensors for label-free detection offer a huge variety of applications in life sciences and medicine since they facilitate point-of-care diagnostics. We use goblet-shaped polymeric high-Q WGM microresonators fabricated within a low-cost manufacturing process also suitable for mass production. After fabrication the polymeric resonators are coated with titanium dioxide using sputter deposition techniques. The sensitivity as figure of merit is given here by the size of the shift of a resonant mode when the surrounding of the resonator changes. Finite element simulations predict a significantly increased sensitivity for resonators coated with TiO_2. Moreover, titanium dioxide is a well-suited platform for functionalization with dopamine derivates. The use of antibody-protein binding processes is expected to enable the specific detection of proteins and antibodies interesting for medical analysis.