Q 35 Poster Photonische Kristalle

Zeit: Dienstag 16:30–18:30 Raum: Labsaal

Q 35.1 Di 16:30 Labsaal

All-optical switching in metallic photonic crystals — •Dietmar Nau[1], Ralph P. Bertram[2], Karsten Buse[2], Thomas Zentgraf[3], Jürgen Kuhl[3], Sergei G. Tikhodeev[4], and Harald Giessen[5] — [1]Institut für Angewandte Physik, Universität Bonn, Wegelerstraße 8, D-53115 Bonn — [2]Physikalisches Institut, Universität Bonn, Wegelerstrasse 8, D-53115 Bonn — [3]Max-Planck-Institut für Festkörperforschung, Heisenbergstraße 1, D-70569 Stuttgart — [4]A. M. Prokhorov General Physics Institute RAS, Moscow 119991, Russia — [5]4. Physikalisches Institut, Universität Stuttgart, Pfaffenwaldring 57, D-70550 Stuttgart

Metallic photonic crystals slabs (MPCS) and photoaddressable polymers (PAP) have attracted a lot of interest recently. Both materials are considered to have the potential to be used in future optical device applications. In this work we combine a MPCS with an additional PAP-layer. We show that the optical properties of this metal-polymer compound system can be reversibly switched all-optically. The optical properties of the system are dominated by the pronounced and steep optical resonances of the MPCS. The large variable birefringence of PAP upon light illumination is used to shift the resonances spectrally. We used a pump-probe experiment to examine the influence of light polarization and exposure on the optical properties [1]. Large spectral shifts of the resonances as well as the reversibility of the switching effect are observed. Comparing the experimental results with scattering-matrix calculations reveals the underlying refractive index changes and allows a quantitative modeling of the compound system.

[1] D. Nau et al., Appl. Phys. B, in press (2006).

Q 35.2 Di 16:30 Labsaal

Director Fields and Optical Properties of Liquid Crystals in Photonic Crystals — •Heinz Kitzerow and Heinrich Matthias — Universität Paderborn, Warburger Str. 100, 33098 Paderborn

It is well known that nematic liquid crystals can be utilized to shift the stop band of a photonic crystal. Research on the director field of liquid crystals filled in macropores is necessary in order to achieve a better understanding of the optical properties of these tunable photonic crystals. Our recent studies on homeotropically aligned liquid crystals show that the modulation of the pore diameter stabilizes periodic arrays of ring disclinations in an escaped radial director field [1]. In this contribution, theoretical examinations of the transmission spectra using both the Berreman 4x4-matrix method and a one dimensional transfer model are presented and compared to experimental results.

[1] H. Matthias, T. Röder, S. Matthias, R. B. Wehrspohn, S. Picken and H.-S. Kitzerow: "Spatially Periodic Liquid Crystal Director Field Appearing in a Photonic Crystal Template", Appl. Phys. Lett. 87, 241105 (2005).

Q 35.3 Di 16:30 Labsaal

Effective mirror model for disordered quasi-1d photonic crystals — •Meikel Frank[1] and Kurt Busch[1,2,3] — [1]Institut für Theoretische Festkörperphysik, Universität Karlsruhe — [2]Institut für Nanotechnologie, Forschungszentrum Karlsruhe in der Helmholtz-Gemeinschaft — [3]DFG Forschungszentrum Center for Functional Nanostructures (CFN), Universität Karlsruhe

Based on the S-matrix-method of Lalanne[1] we present a theoretical model describing the propagation and coupling losses in disordered quasi-1d photonic crystals(PCs). This is done by separately studying the in/out-coupling between planar wave guides and semi-infinite PCs. For these systems we create an effective mirror describing the interfaces via reflection, transmission and scattering losses. The model is tested by comparing its predictions with exact numerical calculations of transmission and reflection through ideal finite-sized PCs. Based on that, we extend our study to include the effects of various types of fabrication tolerances. This allows us to investigate how different types of disorder affect the performance of finite-sized PCstructures. Therefore, the study is of particular interest for the development of PC functional elements.

[1] P.Lalanne, J.-P.Hugonin and Q.Cao J.Opt.Soc.Am.A **18** 11 2001

Q 35.4 Di 16:30 Labsaal

Electrooptically Tunable Photonic Crystals — •Jan Hendrik Wülbern[1], Markus Schmidt[1], Manfred Eich[1], Uwe Hübner[2], Richard Boucher[2] und Rudolf Zentel[3] — [1]Technische Universität Hamburg Harburg, Materialien der Elektrotechnik und Optik, Eissendorferstraße 38, 21073 Hamburg — [2]Institut füt Physikalische Hochtechnologie Jena, A. Einstein Str. 9, 07745 Jena — [3]Institut für Organische Chemie, Universität Mainz, Duesbergweg 10 - 14, 55099 Mainz

We report on electrooptical modulation in a photonic crystal slab waveguide resonator which contains a nanostructured second-order-nonlinear optical polymer. The electrooptical susceptibility in the core was induced by high electric-field poling. A square lattice of holes carrying a line-defect was transferred into the slab by electron-beam-lithography and reactive-ion-etching. Applying an external electric modulation voltage to electrodes leads to a linear electrooptical shift of the resonance spectrum based on the electronic displacement polarization in a noncentrosymmetric medium (Pockels-effect). This effect is therefore inherently faster than other electrooptic modulation effects in nanophotonics.

Q 35.5 Di 16:30 Labsaal

Emissionsspektrum eines mit Yb dotierten mikrostrukturierten Faserlasers — •Sergej Wexler[1], Klaus Mörl[2], Klaus Sengstock[1] und Valeri Baev[1] — [1]Institut für Laserphysik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg — [2]Institut für Physikalische Hochtechnologie, Albert-Einstein-Straße 9, 07745 Jena

Mikrostrukturierte Fasern erlauben Absorptionsmessungen durch Lichtabsorption der evaneszenten Lichtwelle in Luftkanälen der Faser, die mit dem Probegas gefüllt sind [1]. Die Nachweisempfindlichkeit dieser Messungen ist durch die Länge der Faser bestimmt. Eine substantielle Erhöhung der Empfindlichkeit wird erwartet, wenn sich die mikrostrukturierte Faser innerhalb des Resonators eines Vielmodenlasers befindet [2]. Aus dieser Hinsicht ist die Verwendung von dotierten, mikrostrukturierten Fasern besonders günstig. Wir haben verschiedene dotierte und undotierte mikrostrukturierte Fasern untersucht und festgestellt, dass das Emissionsspektrum eines Vielmodenlasers mit einer mikrostrukturierter Faser durch spektrale Modulation stark ausgeprägt ist. Diese Modulation entspricht mehreren "microbandgaps", die durch Spektralmodulation der transversalen Komponente des Lichtfeldes auftritt. Aus diesem Grund sollte für empfindliche Messungen eine mikrostrukturierte Faser mit "random-hole"-Konfiguration [1] besonderes gut geeignet sein.

[1] G.Pickel, W.Peng, A.Wang, Opt.Lett. 29, 1476 (2004)
[2] V.M.Baev, T.Latz, P.E.Toschek, Appl.Phys. B 69, 171 (1999)

Q 35.6 Di 16:30 Labsaal

Interface Design in Photonic Crystals — •Daniel Hermann[1,2], Sergei Mingaleev[1,2], and Kurt Busch[1,2,3] — [1]Institut für Theoretische Festkörperphysik, Universität Karlsruhe — [2]DFG Forschungszentrum Center for Functional Nanostructures (CFN), Universität Karlsruhe — [3]Institut für Nanotechnologie, Forschungszentrum Karlsruhe in der Helmholtz-Gemeinschaft

We present scattering matrix calculations using localized photonic Wannier functions as optimally adapted basis [1,2] to efficiently characterize interfaces between different photonic functional elements, such as coupled waveguides in two different photonic crystals. The Wannier function S-matrix approach allows us to design the coupling region in such a way that the transmission through these interfaces is optimized over a desired frequency range. Furthermore, the method may also be applied to find efficient coupling designs between slab waveguides and PC line defect waveguides.

[1] J. Phys.: Condens. Matter 15, R1233 (2003)
[2] Opt. Lett. 28, 619 (2003)

Q 35.7 Di 16:30 Labsaal

Microscopic self-consistent analysis of the light-matter coupling in semiconductor photonic-crystal structure — •Torsten Meier[1], Bernhard Pasenow[1], Matthias Reichelt[1,2], Tineke Stroucken[1], Armis R. Zakharian[2], Jerome V. Moloney[2], and Stephan W. Koch[1] — [1]Department of Physics and Material Sciences Center, Philipps University, Renthof 5, D-35032 Marburg — [2]Arizona Center for Mathematical Sciences, University of Arizona, Tucson, AZ 85721, USA