Q 64.7 Do 15:30 HI

Recent progress in silicon double inversion of three-dimensional polymer photonic crystal templates — •Martin Hermatschweiler[1], Markus Deubel[1,2,3], Martin Wegener[1,2,3], Fabian Pérez-Willard[3], Nicolas Tétreault[4], Geoffrey A. Ozin[4], and Georg von Freymann[3] — [1]Institut für Angewandte Physik, Universität Karlsruhe (TH), 76128 Karlsruhe — [2]Institut für Nanotechnologie, Forschungszentrum Karlsruhe, 76021 Karlsruhe — [3]CFN, Universität Karlsruhe (TH), 76128 Karlsruhe — [4]Department of Chemistry, University of Toronto, Toronto, Ontario M5S 3H6, Canada

We present recent progress in converting polymer templates into 3D silicon (Si) photonic crystals (PCs) by using a silicon-double-inversion procedure [1]. This has led to Si woodpiles with both improved structural and optical quality. In a first step the polymer template is infiltrated with amorphous silica by applying atomic layer deposition (ALD). After removal of the silica cap layer via reactive ion etching (RIE) the polymer is either combusted or etched in air plasma, which results in a silica inverse woodpile. Now, ALD can be repeated in order to fine-tune the filling fraction of the resulting Si PC, thereby allowing optimization of the photonic bandgap. Next the woodpile is infiltrated with Si by chemical vapor deposition with disilane as the precursor. Again, the Si cap layer is removed by RIE. Wet etching with a few drops of 1% HF placed on the structure finally double-inverts the original template into its Si replica. The original substrate is kept during all process steps, thus paving the way for in-plane optical characterization of three-dimensional Si PCs.
[1] N. Tétreault et al., Adv. Mater., DOI: 10.1002/adma.200501674

Q 64.8 Do 15:45 HI

Transparent and high refractive index coatings polymerized by UV lithography and/or two-photon polymerization used for photonic applications — •Pélagie Declerck[1], Ruth Houbertz[1], Carsten Reinhardt[2], and Boris Chichkov[2] — [1]Fraunhofer-Institut für Silicatforschung ISC, Neunerplatz 2, 97082 Würzburg, Germany — [2]Lazer Zentrum Hannover LZH, Hollerithallee 8, 30419 Hannover, Germany

High refractive index inorganic-organic hybrid materials were synthesized by hydrolysis/polycondensation reactions of organoalkoxysilanes and titanium or zirconium alkoxide precursors. The organic moieties used for organically functionalizing the inorganic-oxidic units allow one to polymerize the materials directly either by UV lithography or by two-photon polymerization (2PP) processes. Both processes require a photoinitiator which is added to the resins and absorbs in the UV (λo) and the NIR (2λo), respectively. The materials have to absorb in the UV regime, while for the 2PP process, they have to be highly transparent at the laser wavelength (780 to 840 nm). The parameters influencing the refractive index such as kind and amount of organoalkoxysilanes, amount of hetero element alkoxide, concentration of the catalyst, and the curing temperatures for coatings were investigated. The properties of the synthesized hybrid materials and the resulting layers were characterized by spectroscopic and microscopic methods. Besides, experiments on the technological processing of the resins were carried out in order to determine their ability to be patterned by UV light and by 2PP processes, respectively.