

Multilayer hole-mask colloidal nanolithography for large-area low-cost complex complex 3D plasmonics

and

Broadly tunable Watt-level femtosecond soliton-seeded optical parametric amplifier in the near- and mid-infrared

By

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Date: 30 January 2014 (Thursday)

Time: 11.00am – 12.30pm

Venue: MAS Executive Classroom 2 (SPMS-MAS-03-07)

Host: Asst. Prof. Cesare Soci

Abstract

We use low-cost multilayer hole-mask colloidal nanolithography to manufacture a variety of large-area complex plasmonic nanostructures with multiple shapes. The first large-area 3D chiral plasmonic structures with C₃ symmetry (i.e., 120° rotation symmetry) are realized with this advanced fabrication technique. Additionally, we manufacture polarization-independent split-ring metamaterials, broadband or multi-peak infrared antennas for SEIRA spectroscopy, as well as nanostructures with simultaneous SERS and SEIRA enhancement in the visible and near-IR range with this method. Furthermore, large-area bi-metallic plasmonic structures show great potential for optical gas sensing as well as for hybrid chiral nonreciprocal devices.

and

Furthermore, we generate more than one Watt of tunable near-IR (1350-2000 nm) and more than half a Watt of mid-IR (2.0-4.7 μm) femtosecond radiation by pumping an optical parametric amplifier directly with a 7.4 W Yb:KGW oscillator at 41.7 MHz repetition rate. Seeding by an optical soliton from a tapered fiber followed by two conversion stages based on MgO:PPLN crystals lead to a highly efficient and continuously tunable frequency conversion device. The system is extremely simple and very stable and could make complex OPOs obsolete.

Short Biography



Harald Giessen (*1966) graduated from Kaiserslautern University with a diploma in Physics and obtained his M.S. and Ph.D. in Optical Sciences from the University of Arizona in 1995. After a postdoc at the Max-Planck-Institute for Solid State Research in Stuttgart he moved to Marburg as Assistant Professor. From 2001-2004, he was associate professor at the University of Bonn. Since 2005, he holds the Chair for Ultrafast Nanooptics in the Department of Physics at the University of Stuttgart.

He was guest researcher at the University of Cambridge, and guest professor at the University of Innsbruck and the University of Sydney, at A*Star, Singapore, as well as at Beijing University of Technology. He is associated researcher at the Center for Disruptive Photonic Technologies at Nanyang Technological University, Singapore. He received an ERC Advanced Grant in 2012 for his work on complex nanoplasmonics. He is on the advisory board of the journals "Advanced Optical Materials" and "Nanophotonics: The Journal". He is a Fellow of the Optical Society of America.

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