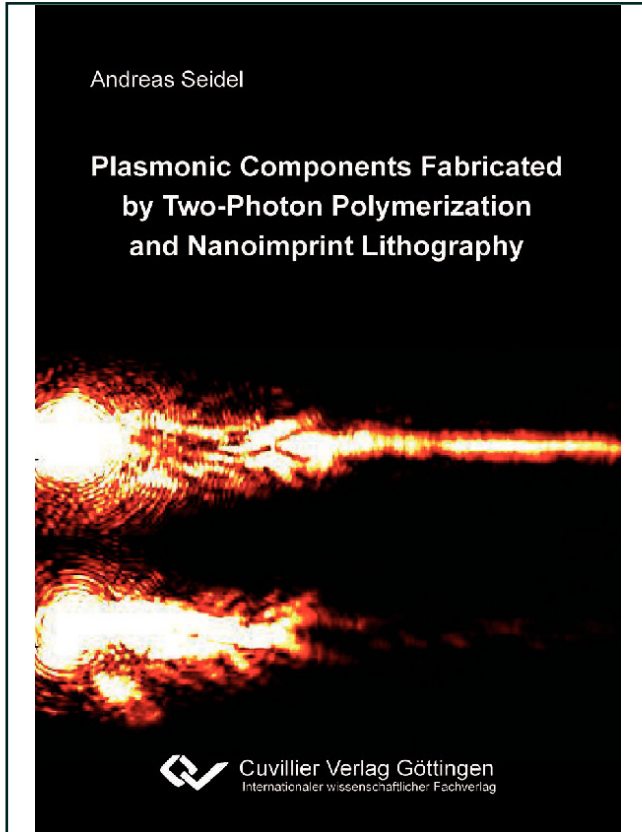




Andreas Seidel (Autor)

**Plasmonic Components Fabricated by Two-Photon
Polymerization and Nanoimprint Lithography**



<https://cuvillier.de/de/shop/publications/514>

Copyright:

Cuvillier Verlag, Inhaberin Annette Jentsch-Cuvillier, Nonnenstieg 8, 37075 Göttingen, Germany
Telefon: +49 (0)551 54724-0, E-Mail: info@cuvillier.de, Website: <https://cuvillier.de>

Contents

1	Introduction	1
1.1	A Brief Introduction to the History of Optics & Plasmonics	1
1.2	Introduction to Surface Plasmon-Polaritons	5
1.3	Motivation for DLSPPW	8
1.3.1	Silicon on Insulator	12
1.3.2	Photonic Crystals	13
1.3.3	Dielectric-Loaded Surface Plasmon-Polariton Waveguides	15
2	Fabrication Methods	16
2.1	Direct Laser Writing by 2-Photon Polymerization	16
2.1.1	2-Photon Polymerization	16
2.1.2	Description of 2PP setup	19
2.1.3	2PP Fabrication Software and Programmes	21
2.1.4	2PP Fabrication Procedures	21
2.1.5	2PP on Glass vs. Gold	22
2.2	Nanoimprint Lithography	23
2.3	Comparison with Other Fabrication Methods	25
2.3.1	UV Mask Lithography	25
2.3.2	Electron Beam Lithography	27
2.3.3	Less Common Methods & Tabular Comparison of Fabrication Methods	27
2.4	Overview of Equipment and Resist Materials	29
2.4.1	Lasers for 2PP	29
2.4.2	Photoresists Used in Fabrication	30
3	Simulation Tools	34
3.1	FDTD Simulations	34
3.2	Green's Tensor Calculations	39
4	Characterization Methods	44
4.1	Introduction to Leakage Radiation Microscopy	44
4.2	Principles of Leakage Radiation Microscopy	45
4.2.1	Description of Experimental Setup	46
4.2.2	Description of Result Analysis	49
4.3	Fibre-Coupled Measurements	52
4.4	Scanning Near-Field Optical Microscope	53
4.5	Comparison of Plasmonic Characterization Techniques	55
4.6	Other Characterization Tools	55
4.6.1	Optical Microscope	55
4.6.2	Scanning Electron Microscope	56
4.6.3	Confocal Imaging Profiler	57

5	Dielectric-Loaded Surface Plasmon-Polariton Waveguide Components Fabricated by Direct Laser Writing	58
5.1	Simple Structures - Lines and Bends	58
5.2	Mach-Zehnder Interferometers	70
5.3	Racetrack Resonators	75
5.4	Symmetric and Asymmetric Splitters	77
6	Nanoimprinted Dielectric-Loaded Surface Plasmon-Polariton Waveguides	85
6.1	Nanoimprinted DLSPPW for Leakage Radiation Microscopy	85
6.2	Fibre-coupled DLSPPW	89
7	Localized Surface Plasmon Experiments	106
7.1	Interference of SPPs	106
7.2	Interaction of SPPs with Gold Nanoparticles	109
7.3	Plasmonic Black Holes	119
8	Conclusion & Outlook	123
9	Bibliography	125
A	List of Scientific Publications by the Author	148
A.1	List of Journal Articles	148
A.2	List of Invited and Post Deadline Talks	149
A.3	List of Conference Contributions and Proceedings	149
B	Curriculum Vitae	152
C	Acknowledgements	153