



Thin Film Micro-Optics: New Frontiers of Spatio-Temporal Beam Shaping

Ruediger Grunwald

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"Thin-film microoptics" stands for novel types of microoptical components and systems which combine the well-known features of miniaturized optical elements with the specific advantages of thin optical layers. This approach enables for innovative solutions in shaping light fields in spatial, temporal and spectral domain. Low-dispersion and small-angle systems for tailoring and diagnosing laser pulses under extreme conditions as well as VUV-capable microoptics can be realized. Continuous-relief microstructures of refractive, reflective and hybrid characteristics are obtained by vapor deposition technologies with shadow masks in rotating systems. The book gives a comprehensive overview on fundamental laws of microoptics, types of thin-film microoptical components, methods and constraints of their design, fabrication and characterization, structure transfer into substrates, optical functions and applications. Recent theoretical and experimental results of basic and applied research are addressed. Particular emphasis will be laid on the generation of localized, nondiffracting few-cycle wavepackets of extended depth of focus and high tolerance against distortions. It is shown that the spectral interference of ultrabroadband conical beams results in spatio-temporal structures of characteristic X-shape, so-called X-waves, which are interesting for robust optical communication. New prospects are opened by exploiting small conical angles from nanolayer microoptics and self-apodized truncation of Bessel beams leading to the formation of single-maximum nondiffracting beams or "needle beams". Thin-film microoptical beam shapers have an enormous potential for future applications like the two-dimensional ultrafast optical processing, multichannel laser-matter interaction, nonlinear spectroscopy or advanced measuring techniques.

- Introduces a new and promising branch of microoptics
- Gives a compact overview on the types, properties and applications of the most important microoptical components containing valuable data and facts
- Helps to understand the basic optical laws
- Reports on the historical development line of thin-film microoptics
- Provides brand new results of research and development in the field of ultrashort-pulse laser beam shaping and diagnostics
- Discusses the future trends and first approaches of next generation microoptics
- Contains a carefully assorted glossary of the most important technical terms

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