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“Multi-photon lithography for optics and photonics”

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場 所：理学部1号館3階340号室＋ZOOMでの開催（事前登録制）

【Abstract】

The use of ultrafast lasers enables target laser-matter interaction, fostering the growth of innovative and rapidly advancing manufacturing technologies. One such technology is multi-photon lithography (MPL), which facilitates maskless 3D structuring of photosensitive materials, primarily photoresists, at the micro- and nanoscale due to a nonlinear absorption phenomenon triggered by threshold excitation upon a certain dose of laser radiation. The resulting unique combination of flexibility, versatility, and high resolution makes MPL highly attractive for use in multidisciplinary fields, particularly in optics and photonics [1], while MPL continuously advances in both technical [2] and material aspects [3]. This work demonstrates how MPL can offer tremendous possibilities for versatile and advanced engineering applications in optics and photonics, addressing 2D, 2.5D, and 3D manufacturing in a single approach. We present high-fidelity micro-optical element, which have enormous potential to enhance the lateral resolution of optical microscopes [4]. Additionally, we demonstrate the effective realization of 2D/2.5D photonic structures on large areas on challenging substrates such as silicon or silicon-on-insulator. These structures may be suitable for applications ranging from the mid-IR to the THz regime, providing an alternative solution to conventional optics. Finally, we present a novel 3D photonics approach to customize the epsilon-near-zero (ENZ) behavior of Transparent Conductive Oxides in a 3D environment. This method involves fabricating 3D photonic crystals (PCs) via MPL and coating them with aluminum-zinc-oxide (AZO) using pulsed laser deposition. AZO-coated PCs represent a promising approach for tunable photonic devices, especially in the telecommunication band.

References:
[1] Wang, H., Zhang, W., Ladika, D., et al. Adv. Funct. Mater., 33, 2214211 (2023).
[2] Zyla, G., Farsari, M. Laser Photonics Rev. 2301312 (2024).
[3] Ladika, D., Noirbent, G., Dumur, F. et al. Appl. Phys. A, 128, 745 (2022).
[4] Zyla, G., Maconi G., Nolvi A., et al. Light: Adv, Manuf., 5, 19 (2024).

使 用 言 語 ： 英語 (English)
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