TOWARDS 3D PRINTED STANDARD PROBES FOR FLUORESCENCE MICROSCOPY

Verena Richter[1], Manuel Rank[1], Sangeetha Suresh Nair[1], Andreas Heinrich[1], and Herbert Schneckenburger[1]
[1]Aalen University, Institute of Applied Research, Beethovenstr. 1, 73430 Aalen, Germany
E-mail: verena.richter@hs-aalen.de

KEY WORDS: 3D microscopy, additive manufacturing, quantum dots

Additive Manufacturing (AM) permits numerous novel illumination concepts in optical microscopy. 3D printing allows fast manufacturing of complex design systems and precise fabrication of micro-structures, thus making it possible to create customized and cost-efficient devices. In addition, 3D printed optical arrays can be used as light sources themselves by introducing photoluminescence to the material [1,2].
Careful calibration and instrumentation adjustment are essential for high-precision imaging of fluorescent probes. Fast, inexpensive 3D printing of (multicolor) single quantum dots could provide new reference standards for 3D microscopy (fig. 1(a)).
Narrow band photo-luminescence of different wavelengths emitted simultaneously from a single 3D sample allows measuring several wavelengths with one excitation pulse, thus reducing acquisition time and lowering the light exposure for each probe. Therefore, 3D printed optical arrays might be a good alternative to tunable lasers or spectroscopic devices commonly used for absorption spectroscopy (fig. 1(b)). For 3-dimensional cell assemblies, e.g. multicellular spheroids, the 3D printed device could be adapted to enable simultaneous measurements of different cell types.
Another possible application of additive manufacturing in biomedical optics involves customized sample chambers printed on microscope cover slips or objective slides. These chambers can be optimized for various microscopy techniques, e.g. Light Sheet Fluorescence Microscopy (LSFM) or Structured Illumination Microscopy, and adjusted to samples sizes ranging from cell spheroids to biopsies (fig. 1(c)).

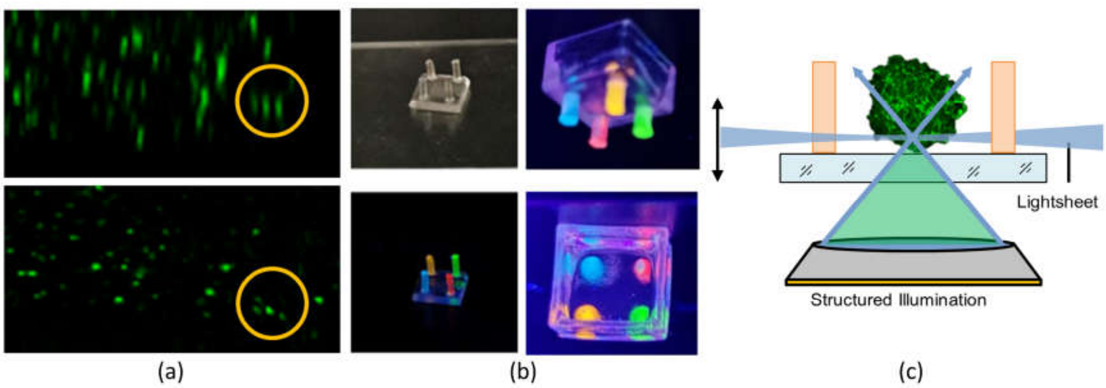

Fig. 1 (a) 3D printed Quantum Dots, (b) Multiple Material Printing within the XY Plane, samples under Ultra Violet Excitation of 370nm, (c) 3D print on a cover slip.

References

[1] S. Suresh Nair, J. Nuding, A. Heinrich, “3D-printed optical active components“, Proc. SPIE 10529, Organic Photonic Materials and Devices XX (2018), doi: 10.1117/12.2287427
[2] S.Suresh Nair, A.Heinrich, M.Klein, and J.Nuding, “Additive Manufacturing of Functional (Photoluminescent) Optical Components”, Proceedings 119. DGaO Tagung, ISSN: 1614-8436, urn:nbn:de 0287-2018-A005-6, (2018).