School for Additive Manufacturing

LASER ZENTRUM HANNOVER e.V.

HIGHLIGHTING NEW POSSIBILITIES: A COMPARISON OF SLOT AND CT IN THE ANALYSIS OF 3D PRINTED OPTICAL ELEMENTS

Ole Hill[1,4], Tobias Biermann[2,3], Gerrit Eckert[3,4,5], Khodor Sleiman[1,3], Lennart Mesecke[2], Katharina Rettschlag[1,3], Peter Jäschke[1], Stefan Kaierle[1,3,6], Nadja Bigall[3,5], Tammo Ripken[1], Roland Lachmayer[2,3], Merve Wollweber[1]

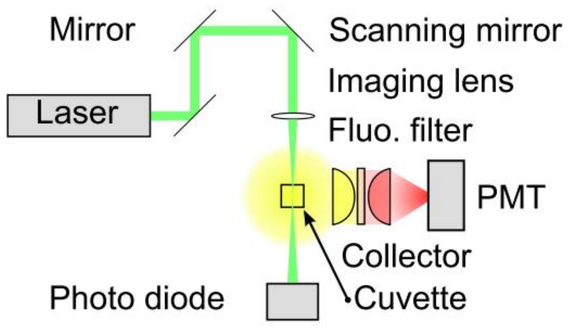
[1] Laser Zentrum Hannover e.V., 30419 Hannover, Germany
[2] Institute of Product Development, Leibniz University Hannover, 30823 Garbsen, Germany
[3] Cluster of Excellence PhoenixD (Photonics, Optics and Engineering – Innovation Across Disciplines), 30167 Hannover, Germany
[4] School for Additive Manufacturing (SAM), 30823 Garbsen, Germany
[5] Institute of Physical Chemistry and Electrochemistry, 30167 Hannover, Germany
[6] Leibniz University Hanover, Institute for Transport and Automation Technology, 30823 Garbsen, Germany

Ole Hill,
M. Sc.

Introduction

- Comparison of Scanning Laser Optical Tomography (SLOT) and Computed Tomography (CT)
- Two examples:
  - a glass cube manufactured by Laser Glass Deposition (LGD) with poor optical quality at printing interfaces
  - Functionalized silicone waveguide with fluorescent core
- SLOT yields different information than CT such as light absorption and fluorescence

Method



Lorbeer et al., 2011

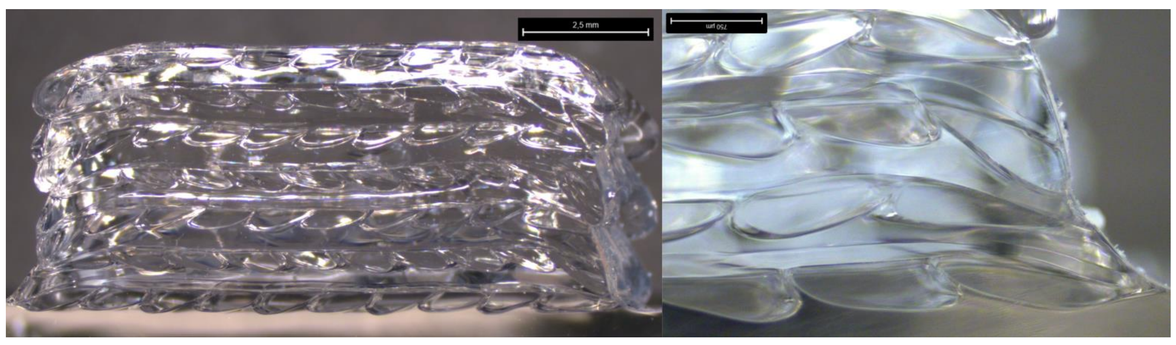
Experimental scheme of SLOT

- Low focused laser beam is scanned over sample
- Pointwise measurement of optical transmission and fluorescence
- Projections over 360° rotation are acquired
- Reconstruction yields volumetric data of optical transmission and fluorescence

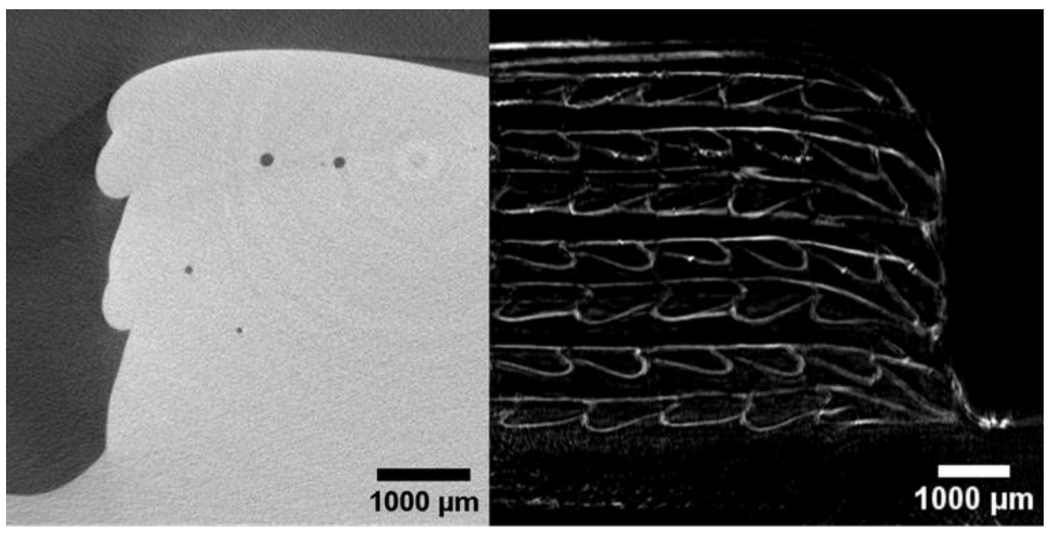
Glass Cube Printed by Laser Glass Deposition

SLOT shows the poor optical quality at layer interfaces

- Photographs show poor optical quality at layer interfaces
- CT shows specimen geometry with high precision and air cavities
- CT cannot resolve optical properties such as refractive index inhomogeneities
- SLOT shows layer interfaces with high precision as well as air cavities

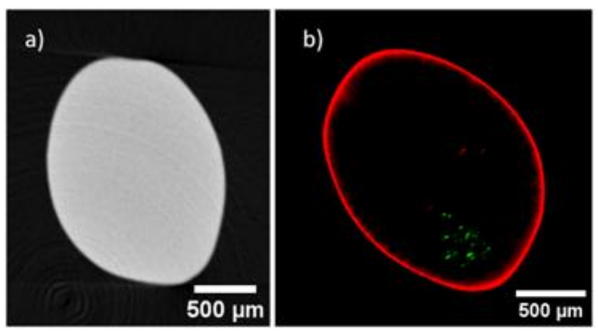


Photographs of a glass cube manufactured by LGD, Sleiman et al., 2023

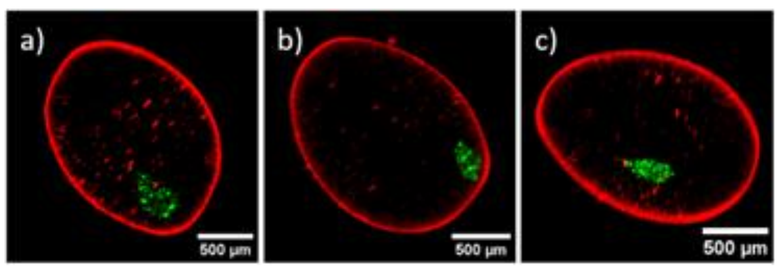


Left: µCT reconstruction shows air cavities; Right: SLOT transmission reconstruction shows printing interfaces

Silicone Waveguides Printed by Embedded Mosquito Printing



Left: µCT image shows only the contour of the specimen; Right: SLOT shows absorption (red) and fluorescence (green)



Three different waveguides: Slot illustrates the position and geometry of the fluorescent core (green) and absorbing structures within the specimen (red)

SLOT allows volumetric resolution of fluorescent core

- The top figure shows the comparison of CT and SLOT reconstructions for a silicone waveguide with a fluorescent core.
- No information about the fluorescent nanoparticles can be drawn from the CT image
- The geometry, absorption and fluorescence of the waveguide can be analyzed in 3D using SLOT
- The bottom figure shows three different waveguides that were printed with different parameters

References

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Leibniz Universität Hannover
LASER ZENTRUM HANNOVER e.V.
HOCHSCHULE HANNOVER UNIVERSITY OF APPLIED SCIENCES AND ARTS
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TU Clausthal

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