School for Additive Manufacturing

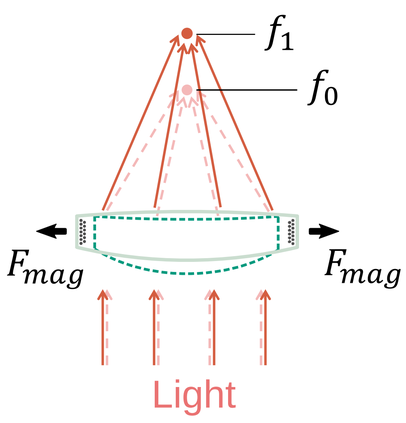
iPeG Institut für Produktentwicklung & Gerätebau

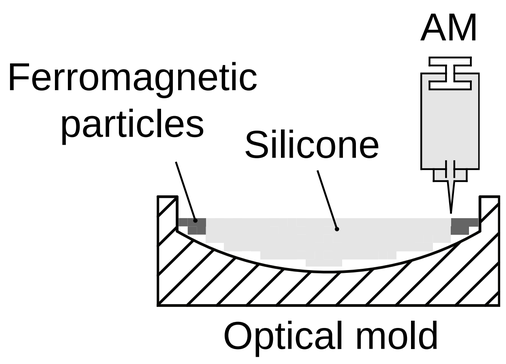
Additive Manufacturing of Functionalized Silicone Optics

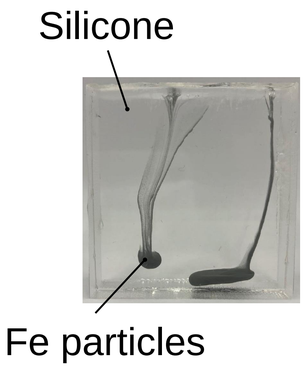
Project goals

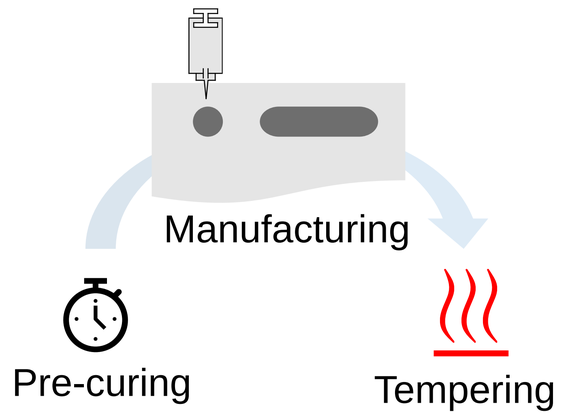
- Exploring viable application spaces for flexible silicone lenses via multiphysical simulation -
- Simplifying complex manufacturing processes for adaptive optics -
- Additive manufacturing and actuation of a ferromagnetic-particle-infused silicone lens -

Functionalizing silicone lenses









Concept: Lens deformation through external magnetic field

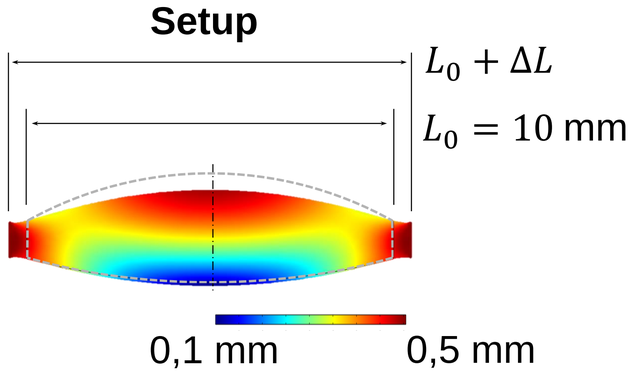
Realization: Utilizing extrusion-based AM for functionalization

Study: Sedimentation of particles

Optimization: Manipulation of silicone‘s curing behavior

Multiphysical simulation of various lens types

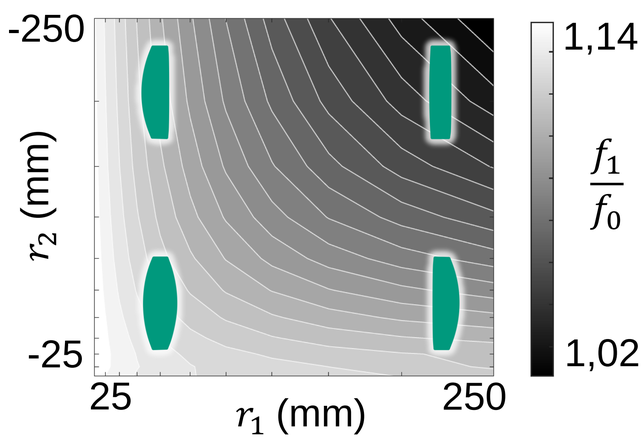
Setup



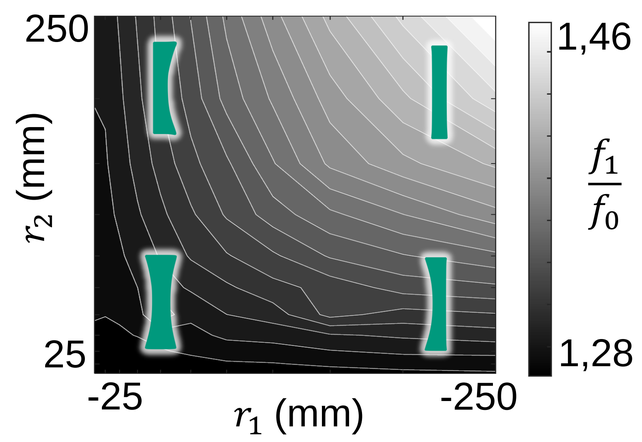
- Coupling deformation and ray tracing
- Elongation of silicone lenses by 10 %
- Focal length shift f_1/f_0

Results

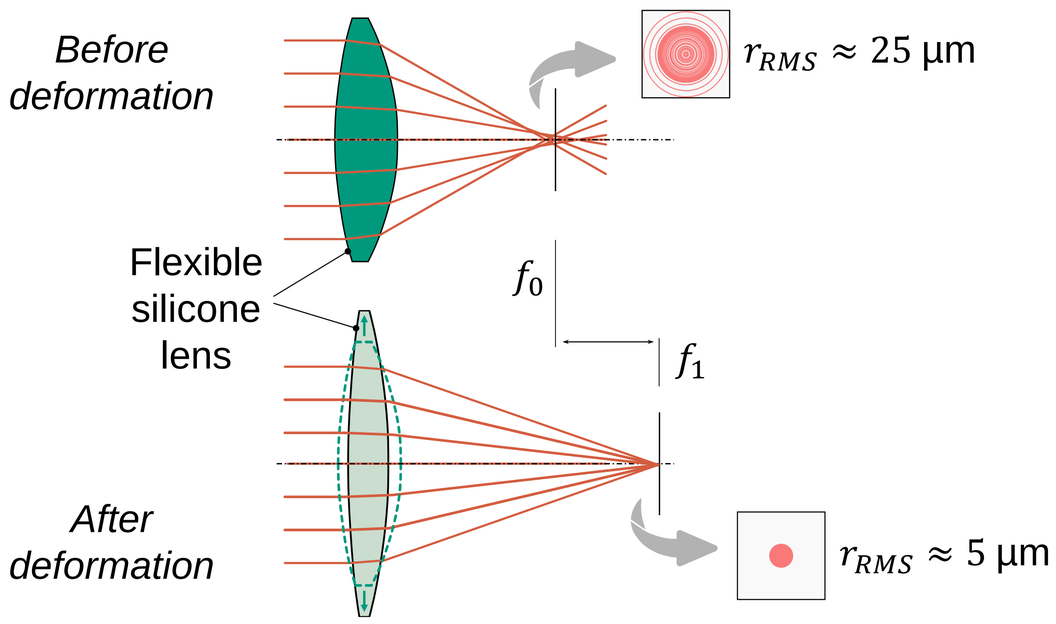
Converging lenses



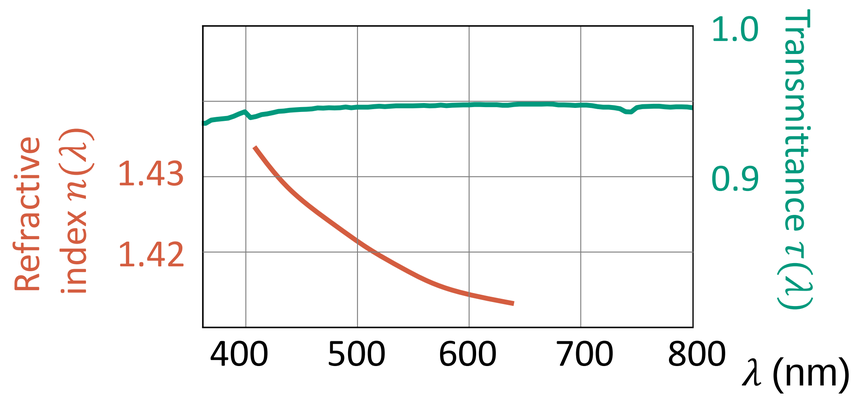
Diverging lenses



Optical effects & properties



- Focal length shift through a single optical element
- Aspherization of lenses improves image quality
- Experimental material data of DOWSIL EI-1184™ :



Publications

A. Ziebehl, T. Grabe, T. Biermann, P, Xia, S. Teves, R. Lachmayer: *Parametric multiphysics study of focus-variable silicone lenses*. Applied Optics 62 (2023), 7895-7903; DOI: 10.1364/AO.499811

A. Ziebehl, T. Biermann, T. Grabe, J. Röttger, P.-P. Ley, A. Wolf, R. Lachmayer: *Potentials and Challenges in Additive Manufacturing of Nanoparticle-infused Silicone Optics*. DGaO-Proceeding (2021); DOI: 10.15488/11522

T. Biermann, A. Ziebehl, T. Grabe, J. Röttger, P.-P. Ley, A. Wolf, R. Lachmayer*: Magnetically actuated solid body PDMS lens*. SPIE Photonics West (2021); DOI: 10.1117/12.2578551

Leibniz Universität Hannover

LZH Laser Zentrum Hannover e.V.

Hochschule Hannover University of Applied Sciences and Arts

Technische Universität Braunschweig

TU Clausthal

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