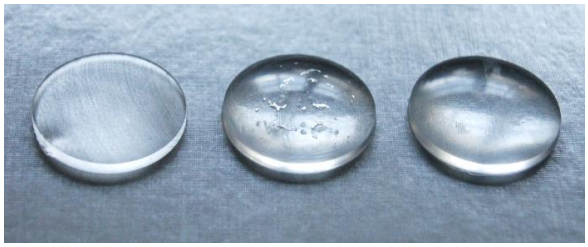
Additive production of functionalized silicone optics

Supervisor: Prof. Dr.-Ing. Roland Lachmayer, Leibniz Universität Hannover, IPeG

Co-Supervisor: Dr.-Ing. Alexander Wolf, Leibniz Universität Hannover, IPeG

Projekt ID: 16

Motivation:



Preliminary tests for the production of highly transparent silicone lenses

While additive manufacturing technologies for metals and polymers have been available on an industrial scale for many years, research into the generative manufacture of silicones is still in its infancy. Especially with regard to optical elements such as lenses, this material class offers a high potential, since it can withstand higher ambient temperatures than polymers and can also be reversibly deformed by mechanical force.

By adding mechanically addressable particles locally, a lens can be deformed in a targeted manner, for example by applying a magnetic field. In this way, optical systems can be realized in the future which can be focused without classical mechanical adjustment devices.

Objective of the PhD project:

Within the scope of this PhD project, mechanically deformable, highly transparent silicone optics are to be produced additively. This requires comprehensive research and preliminary tests to functionalize the silicone matrix. One approach, for example,

This is a PhD-project of *SAM* "School for Additive Manufacturing". *SAM* is a structured PhD-programme of the Leibniz Universität Hannover in cooperation with the Hochschule Hannover, the Laser Zentrum Hannover e. V., the TU Braunschweig and the TU Clausthal.

Students interested in this or any other project of *SAM* can apply for fellowships. Please have a look at https://www.iw.uni-hannover.de/de/forschung/school-for-additive-manufacturing/projekte/ for details.

is the graded (locally variable) addition of metal particles which experience a force effect in a magnetic field. On this basis, a possible approach for realization within the framework of the project duration is selected.

The interaction of mechanical deformation with other optically relevant material properties such as local refractive index, polarization and stress birefringence must be investigated and described mathematically. In a first step, a functional demonstrator, which enables the mechanical addressing of the lens geometry, will be conventionally manufactured.

Subsequently, the knowledge gained is used to enable additive production of a functional pattern. Under certain circumstances, it may be necessary to modify the production plant for highly transparent silicones, which is currently being developed as part of another project at IPeG.

In a final step, the application and design scope for mechanically functionalized silicone optics will be explored.

The PhD project can be divided into three phases

- Description and proof of the realizable effects
- Conventional fabrication of a functionalized silicone optic
- Implementation of the results in an additive manufacturing process