Institut für Chemieingenieurwesen
AG Prof. Dr. Dirk Ziegenbalg

ulm university universität uulm

Bachelor/Masterthesis, Research Internship:

Development, 3D-printing and experimental evaluation of photoactive reactor components

Scope of the Project:

In recent years, heterogeneous photocatalytic reactions gain more and more attention. Typically, these reactions are applied for organic synthesis on lab and industrial scale by using semiconductors such as TiO_2 as photocatalyst. In terms of photochemical reaction engineering this special reaction type raises some new challenges to the reactor design. Compared to homogeneous systems not two but three components (substrate, photon and catalyst) have to be brought into contact.
Nevertheless, most commercially available photoreactors are not adapted to theses special requirements to provide a broad field of application. The QuinoLight project is a cooperative work between the research group Ziegenbalg, the research institute of the DECHEMA and the research group Marschall from University of Bayreuth. Utilizing the photocatalytic synthesis of quinoline, the project's objective is the development and optimization of reactors for photocatalytic systems by application of 3D-printing.

Current scientific work and possible working packages:

One major drawback of photocatalytic systems is still the use of suspensions, requiring a laborous separation of product and catalyst. In recent work at the ICIW new approaches were tested to immobilize the photocatalyst inside the photoreactor. Therefore, a procedure was established, that enabled fabrication of 3D-printing filament that contained the photocatalyst. By feeding these filaments into a 3D-printer, manufacturing of 'photoactive' reactor parts was possible. Activity of these parts was tested in an aqueous test reaction.
However, the final test for the photoactive components in the quinoline synthesis still remains to be done. Thereby, different options for geometries, process conditions, preactivation protocols, etc. should be explored. Thanks to the acquisition of a new filament extruder utilizing string diameter control, new possibilites for process parameters (e.g. catalyst loading) are accessible. For analysis of the new manufactured materials, printability tests, scanning electrone microscopy (SEM) and thermogravimetric analysis (TGA) can be conducted. Finally, electrochemical coated parts should be experimentally tested as a reference and put in competition to the photoactive 3D-printed components.

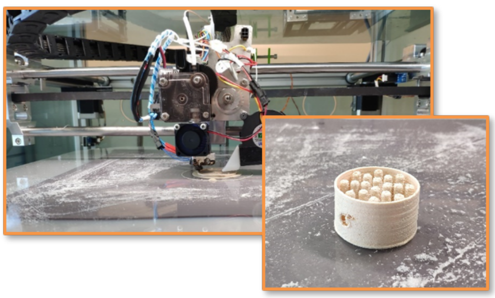

Figure 1: *Printing of a reactor part out of photoactive filament.*

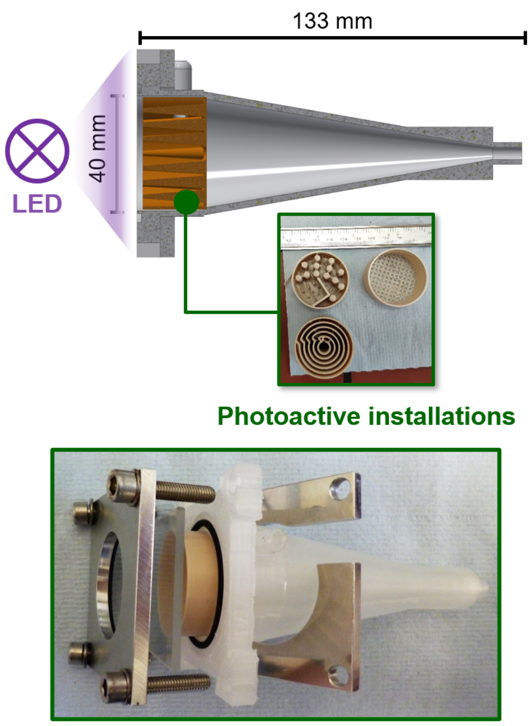

Figure 2: *Reactor model utilizing photoactive installations.*

If interested please contact:

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