Exploring the Potential of Dynamic Covalent Bonds for the Design of Sustainable and 3D-printable Liquid Crystaline Elastomers

Sören Herkströter, Michael Giese*
Faculty of Chemistry (Organic Chemistry) and CENIDE, University of Duisburg-Essen, Universitätsstraße 7, 45141, Essen, Germany
E-mail: michael.giese@uni-due.de, soeren.herkstroeter@uni-due.de

The importance of sustainable and smart materials gains an increasing focus in materials science. The implementation of dynamic covalent chemistry in liquid-crystalline elastomers and networks, has led to a variety of systems that fulfil the requirements of functionality and sustainability. Unfortunately, these systems exhibit a significant disadvantage with respect to processability in 3D printing techniques [1-3]. This highlights the opportunity to further explore the potential of dynamic covalent chemistry in liquid-crystalline elastomers in order to develop sustainable, easily accessible and 3D-printable smart materials. In this project, the aim is to investigate salicylic imines as dynamic covalent bonding motif for processing liquid-crystalline elastomers via 3D printing. The dynamics of the imine bond and the corresponding metathesis and exchange reactions are utilized to crosslink and recycle the 3D-printable ink. To enable optical monitoring of the crosslinking and recycling processes we use an emissive functional cyanostilbene moiety as part of the dynamic bonding motif.

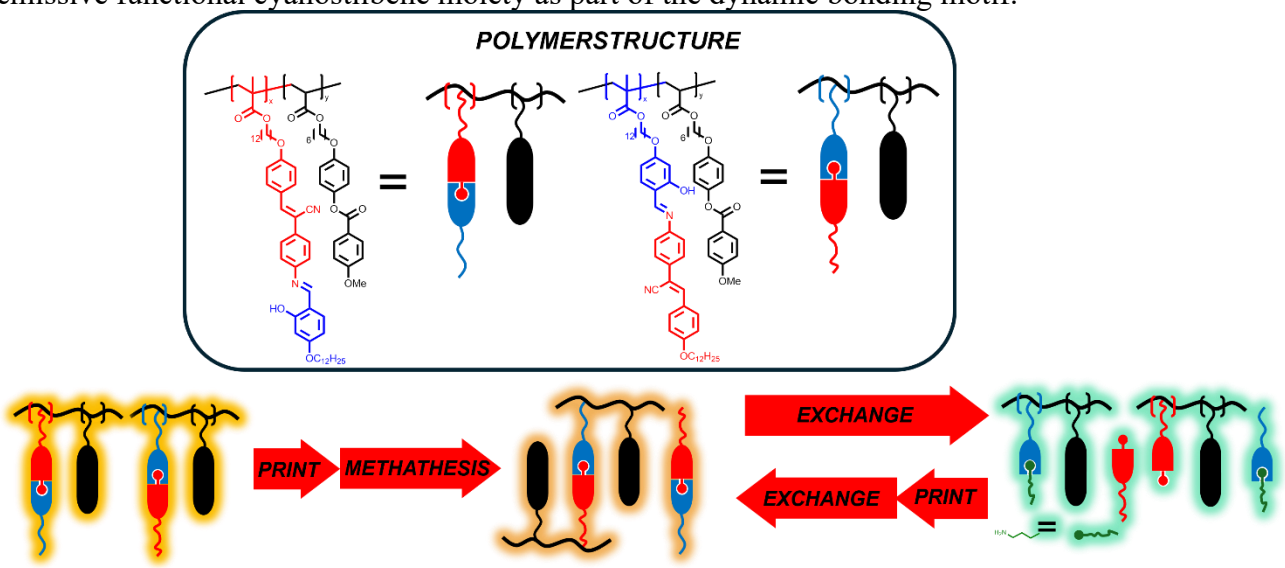

Figure 1. Schematic representation of the molecular structure of the polymer and the implemented crosslinking and recycling mechanisms.

References

[1] Lin, Xueyan, Alexandra Gablier, and Eugene M. Terentjev. "Imine-based reactive mesogen and its corresponding exchangeable liquid crystal elastomer." *Macromolecules* 55.3 **2022**: 821-830.

[2] Jin, Binjie, and Shu Yang. "Programming liquid crystalline elastomer networks with dynamic covalent bonds." *Advanced Functional Materials* 33.45 **2023**: 2304769..

[3] Wang, Zhijian, and Shengqiang Cai. "Recent progress in dynamic covalent chemistries for liquid crystal elastomers." *Journal of Materials Chemistry B* 8.31 **2020**: 6610-6623.