LIGHT ON – CURING OFF: USING ORTHOGONAL PHOTOREACTIONS TO CHANGE CURING KINETICS IN THIOL-ENE SYSTEMS

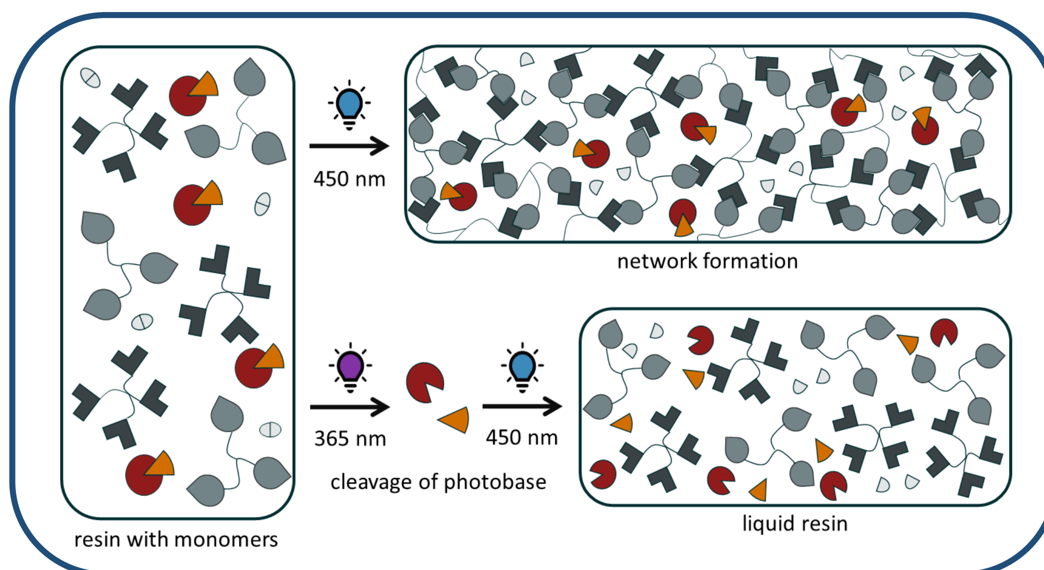
Rita Johanna Höller[1*], Stefanie Monika Müller[1], Sandra Schlögl[2], Thomas Griesser[1]

[1]Institute of Chemistry of Polymeric Materials, Montanuniversität Leoben, Otto Glöckel-Straße 2 A-8700 Leoben, Austria.; [2]Polymer Competence Center Leoben GmbH, Roseggerstrasse 12, A-8700 Leoben, Austria

[*]rita.hoeller@unileoben.ac.at

Thiol-ene chemistry has been a target of comprehensive research for several years, with a special focus on its use in photochemistry. Usually, thiol-ene free-radical reactions are a prominent example of click chemistry – showcasing high yields, a variety of possible monomers and orthogonality towards most other reactions employing functional groups – to name a few characteristics [1]. Especially in 3D-printing for medical applications, otherwise commonly used acrylates are replaced by thiol-ene based resins due to their better biocompatibility.

As previously introduced by Bowman et al., basic amines retard the thiol-ene reaction under certain conditions – mostly dependent on the pKa of the thiol in comparison to the amines' conjugated acids pKa [2]. We transferred this concept to photochemically activated basic compounds to gain additional control over the thiol-ene curing reaction. In our resin system radical curing is activated through a Type II photoinitiator which is most active at 450 nm, whilst having a minimum in absorptivity at 365 nm. Therefore, light with a wavelength of 365 nm is used to trigger the activation of the photolatent base, resulting in an inhibition of the curing reaction. By adapting the amount of photolatent base and the illumination time with 365 nm, it is possible to gain control of the curing kinetics through the use of light. Controlled inhibition and retardation of the thiol-ene curing reaction open the doors to numerous possibilities, such as applications in 3D-printing or advanced photolithography.



References

1. Hoyle, C. E.; Bowman, C. N. Angew. Chem. Int. Ed, 49, 1540-1573, 2010.
2. Love, D. M.; Kim, K.; Goodrich, J. T.; Fairbanks, B. D.; Worell, B. T.; Stoykovich, M. P.; Musgrave, C. B.; Bowman, C.N. J. Org. Chem., 83 (5), 2912−2919, 2018.