

# Borane-mediated Epoxide Polymerization as a Disruptive Technology for Polyether Preparation

Prof. Dr. Stefan Naumann

Polyethers constitute a versatile class of polymers and are found in a broad array of applications (i.e., cosmetics, drug delivery, electrochemical devices, lubricants, rheology modification, PU synthesis). The vast majority of industrially produced polyethers relies on traditional techniques, in particular the conventional anionic polymerization (KOH) of epoxide monomers or the so-called Double Metal Cyanide (DMC) catalysis.

While successful, these techniques suffer from a number of downsides and limitations. Work in the Naumann research group focuses on the development of novel, preferentially metal-free (organocatalytic) polymerization systems which allow for a much larger degree of freedom in designing (co)polyethers. The latter includes (a) circumventing limitations in achievable molar masses, (b) suppression of side-reactions (transfer-to-monomer), (c) the ability to convert highly functionalized epoxides, (d) the investigation of stereoselective polymerization to obtain isotactic polyethers and (e) the up-scaling of such novel processes.

Notably, all of the above points can be addressed via borane-mediated polymerization. The presentation will discuss the general polymerization principle and then move from  $\text{Et}_3\text{B}$  to more advanced catalyst structures, highlighting the impact of borane catalysis on the points (a)-(e).

- [1] *Chiral Diboranes as Catalysts for the Stereoselective Organopolymerization of Epoxides*, A. Sirin-Sariaslan, S. Naumann\*, *Chem. Sci.* **2022**, 13, 10939.
- [2] *Sterically Demanding Binaphthol-Based Chiral Diboranes for the Metal-Free Preparation of Isotactic Poly(propylene oxide)*, A. Sirin-Sariaslan, S. Naumann\*, *Chem. Commun.* **2023**, 59, 11069.
- [3] *A Systematic Study of Nonionic Di- and Multiborane Catalysts for the Oligomerization and Polymerization of Epoxides*, I. Haug, M. Eberhardt, U. Krappe, S. Naumann\*, *Chem. Eur. J.* **2024**, 30, e202401268.