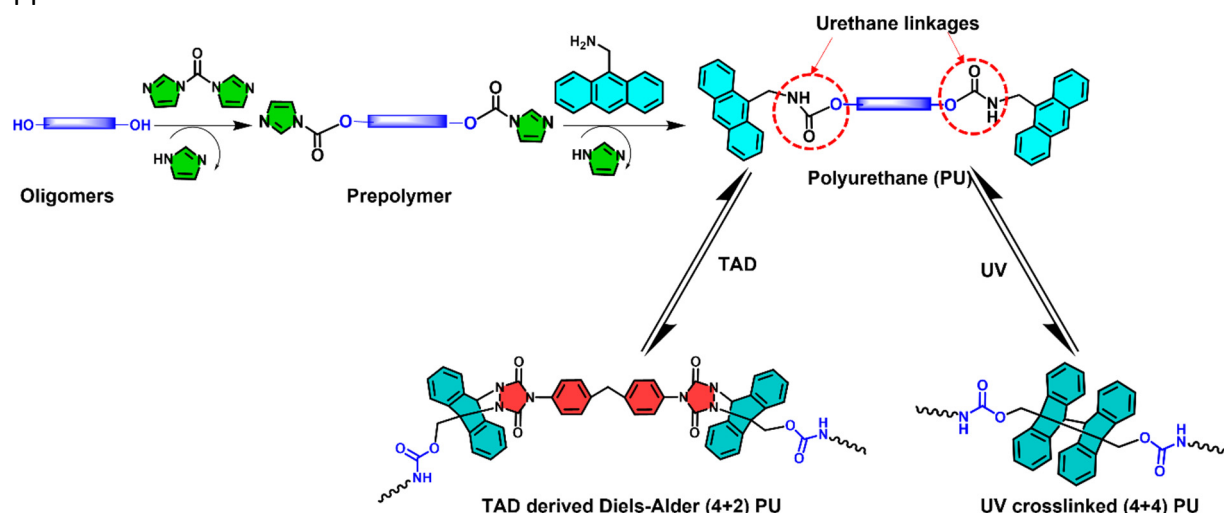


Group : Dynamic Polymers
Project : Self-healable Non-isocyanate Polyurethane via Dynamic Diels-Alder Chemistry
Supervisors : Sagar Kumar Raut and Maarten M.J. Smulders

Introduction:

Conventionally, polyurethane synthesis (PU) involves isocyanates that are inherently toxic and moisture sensitive. To overcome this, we propose to develop PU via a non-isocyanate route, which behaves as smart materials using dynamic covalent chemistry under the stimuli (heat and UV). Initially, anthracenyl end-capped non-isocyanate polyurethane (AnNIPU) will be synthesis using carbonylimidazole-amine reaction a; subsequently, diene PU (AnNIPU) will be crosslinked using 1,2,4-triazoline-3,5-dione (TAD) via Diels-Alder (4+2) and UV (4+4) cycloaddition chemistry at ambient condition. This crosslinked non-isocyanate polyurethane can have interesting properties in self-healing, reshaping, recycling, fluorescence, and bio-based (non-toxic route) applications.



Research Objectives:

- Synthesis and characterization of anthracenyl end-capped PU and TAD crosslinker.
- Characterization of dynamic (4+2) DA and (4+4) UV photocycloaddition networks.
- Properties studied like toxicity, fluorescence, self-healing, and recyclability.

Characterization:

In this project several different characterization techniques (such as NMR, FTIR, GPC, DSC, DMA, Rheology, etc.) will be used to prepare crosslinkers, polymers, and crosslinked materials.

More information:

Sagar Kumar Raut, room Helix 8.055, tel. 0317-482374, e-mail: sagar.raut@wur.nl.

Maarten Smulders, room Helix 8.057, tel. 0317-480435, e-mail: maarten.smulders@wur.nl.

References:

- 1) K. D. Bruycker, S. Billiet, H. A. Houck, S. Chattopadhyay, J. M. Winne, and F. E. Du Prez, *Chem. Rev.* **2016**, *116*, 3919.
- 2) S.K Raut, P. K. Behera, T. S. Pal, P. Mondal, K Naskar and N.K. Singha, *Chem. Commun.*, **2021**, *57*, 1149.
- 3) M. Lanzillotto, L. Konnert, F. Lamaty, J. Martinez and E. Colacino, *ACS Sustainable Chem. Eng.*, **2015**, *3*, 2882.