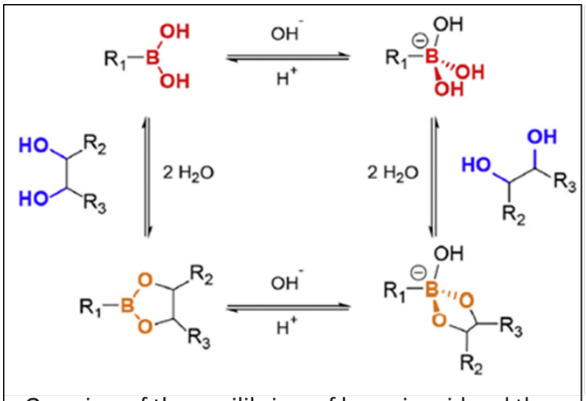
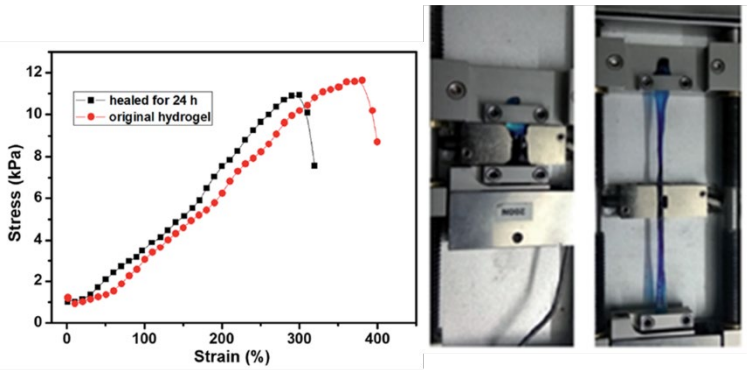
Group : Dynamic Polymers
Project : **Smart Materials – Dynamic Boronic Ester Materials**
Supervisors : Simon van Hurne and Maarten M.J. Smulders

Introduction

In this project we try to develop *smart materials* using reversible covalent chemistry. Reversible or dynamic covalent chemistry consists of covalent bonds that can attach and detach under certain stimuli. This dynamic equilibrium can be controlled with different bond specific stimuli, such as heat or light. By using reversible dynamic covalent bonds in networks, the resulting material can have interesting properties, such as reshaping of the material, improved recycling or self-healing behaviour.



Overview of the equilibrium of boronic acid and the various boronic ester forms.[1]



Tensile curves of dynamic boronic ester containing materials before and after healing.[2]

Here we integrate dynamic *boronic ester* bonds between boronic acids and diols to make *covalent adaptable networks (CANs)*. The properties of these networks can then be controlled, due to the pH sensitive equilibrium of the *boronic ester*.

Research topics

There are several possible research topics within this project, such as:

- Synthesis and characterisation of boronic acid containing polymers;
- Characterisation of dynamic networks containing boronic ester bonds;
- Study of the polymer's 'smart' properties, such as recyclability or self-healing ability.

Techniques to be used

In this project a number of different techniques are used to study the materials. Examples of these techniques are:

- Organic synthesis
- NMR
- Rheology

More information

Simon van Hurne, room Helix 8.056, tel. 0317-482374, e-mail: simon.vanhurne@wur.nl.
Maarten Smulders, room Helix 8.057, tel. 0317–480435, e-mail: maarten.smulders@wur.nl.

References

1. Marco-Dufort, B. and M.W. Tibbitt. *Materials Today Chemistry*, **2019**, *12*, 16-33.
2. An, H., *et al.*, *RSC Advances*, **2020**, *10*(19), 11300-11310.