



# Research projects for MSc in Chemical Engineering @ RaffaLab

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Assistant Professor  
Polymeric Products

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# Important notes

- > Product oriented topics
  - Synthesis of new polymeric products
  - Characterization
  - Study of properties
  
- > Not available at the moment
  - New intake from February/March 2021
  - Max 2 students for this a.a.



# Topics

- > Amphiphilic polymers
  - For enhanced oil recovery
  - For smart materials (sensing/actuation/drug delivery)
  - Anti-bacterial / anti-stain coatings
- > Bio-based materials
  - From sugar industry side streams
    - Biodegradable coatings
  - From starch (also in scCO<sub>2</sub>)
    - Adhesives, emulsifiers, coatings
  - From citric acid and glycerol
    - Super Absorbent Polymers

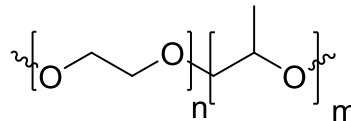


# Amphiphilic polymers (Polymeric surfactants)



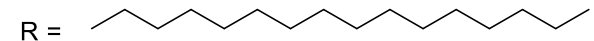
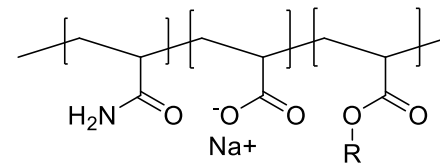
block structures

e.g.: poloxamers

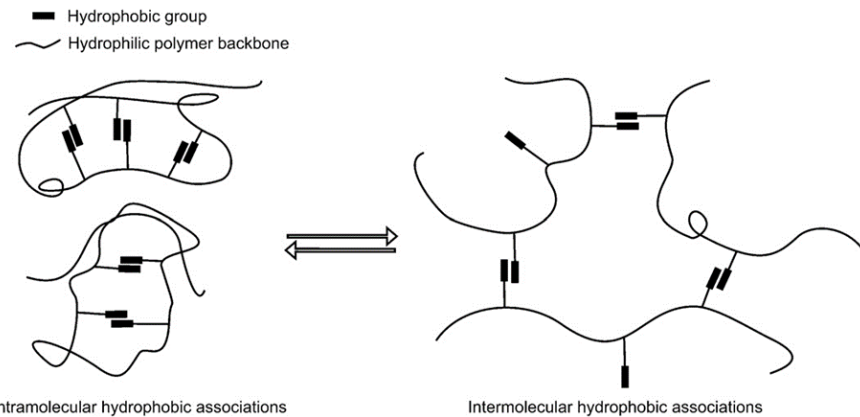


statistic structures

e.g: hydrophobically modified HPAM

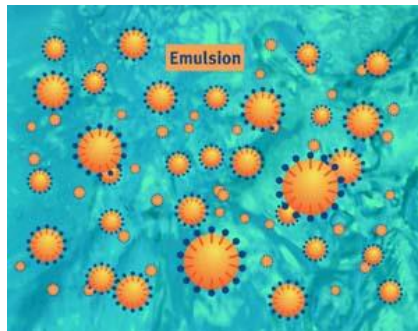


# Amphiphilic Polymers

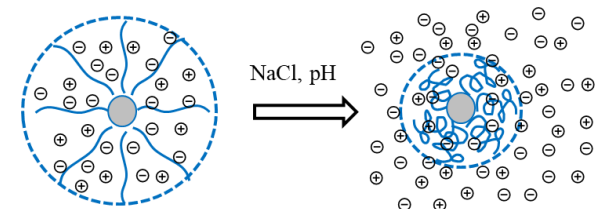


Rheology (viscosity) control

IFT decrease and Emulsion stability



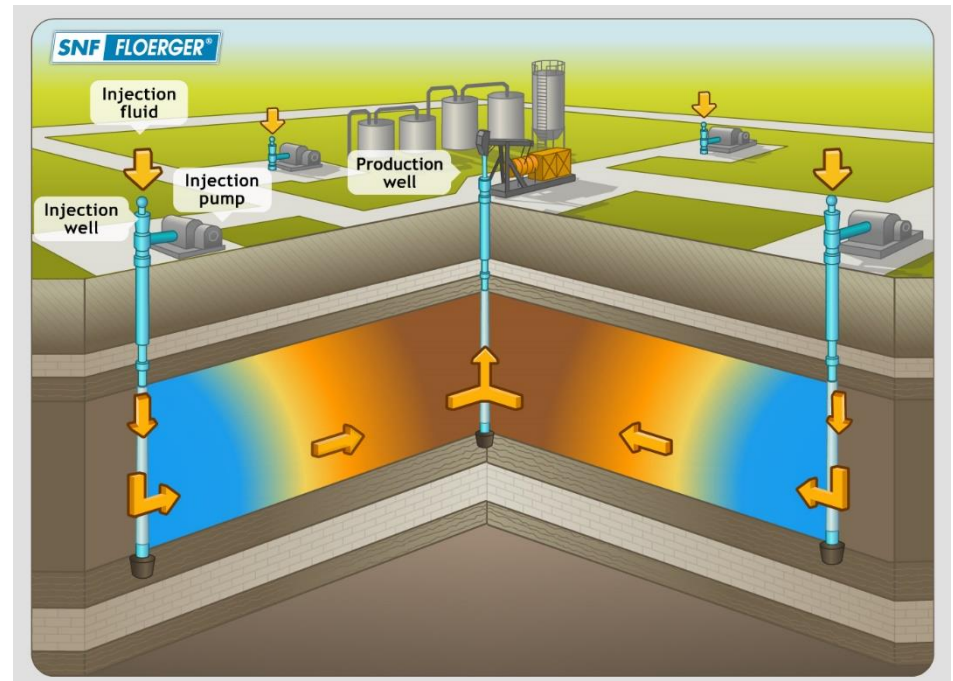
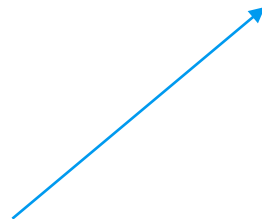
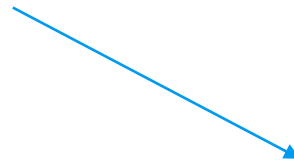
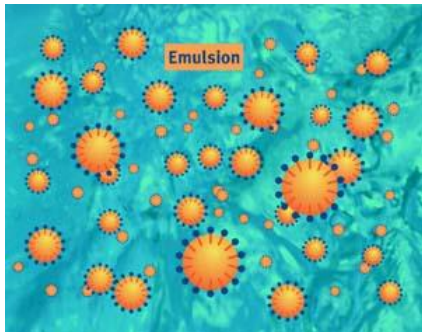
Responsive behavior





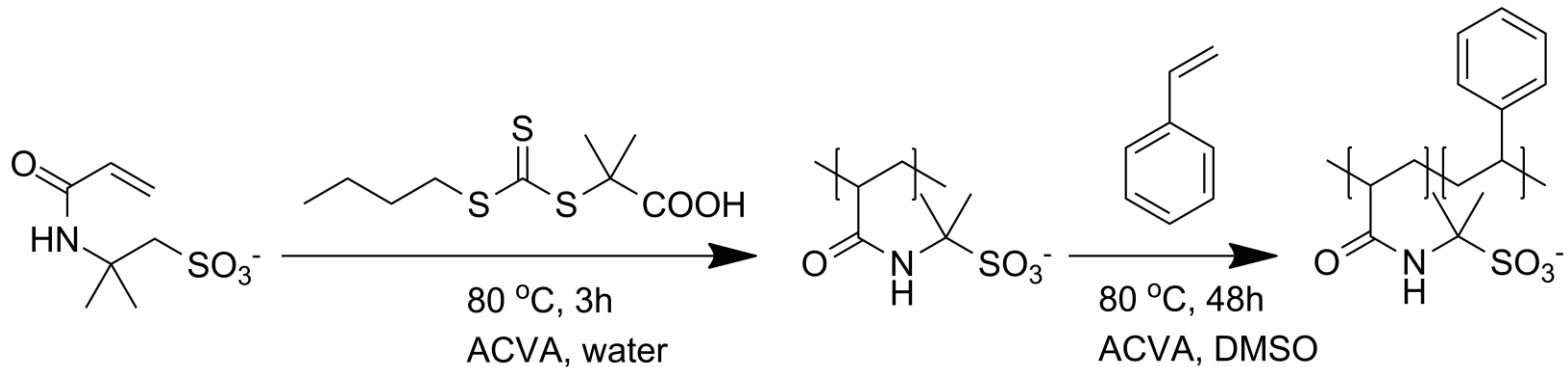
# Amphiphilic Polymers

for EOR



# Amphiphilic Polymers

for EOR

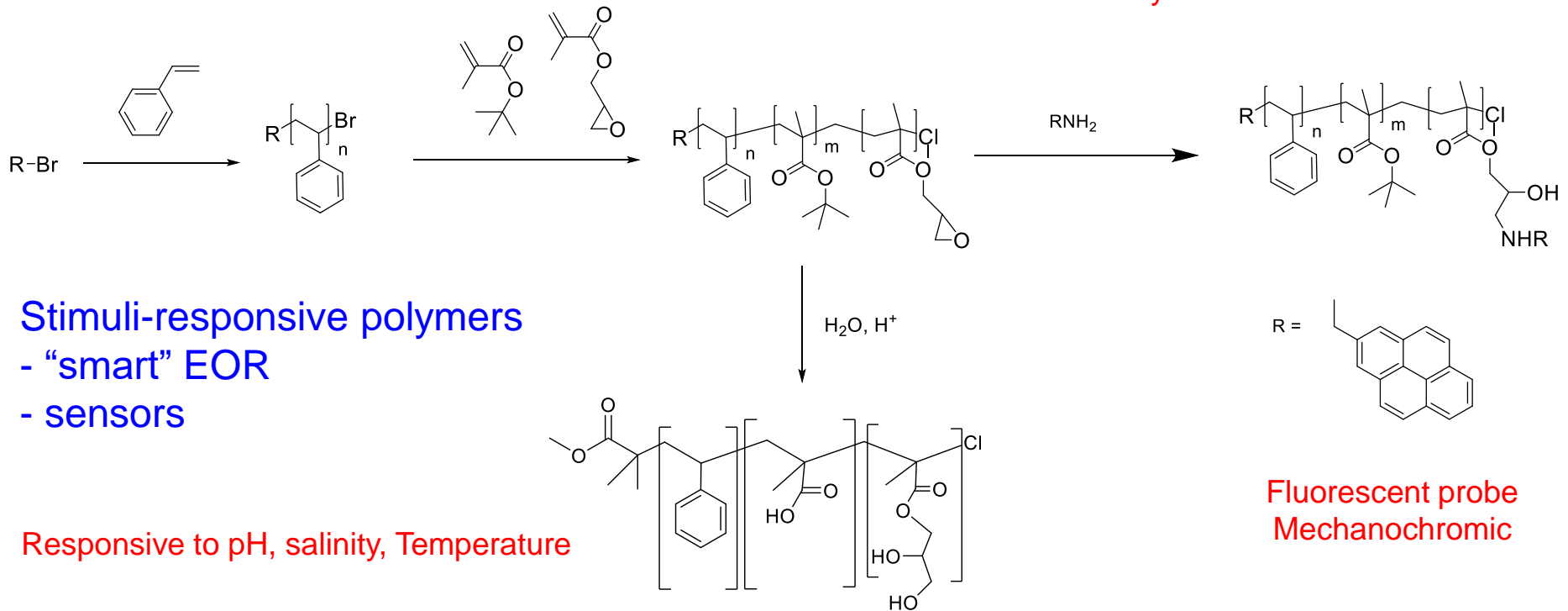


- Synthesis
- Properties water solution
- Possible evaluation in EOR (by Shell)

Project for people who can handle Polish Vodka  
PhD supervisor: Alex Guzik

# Amphiphilic Polymers

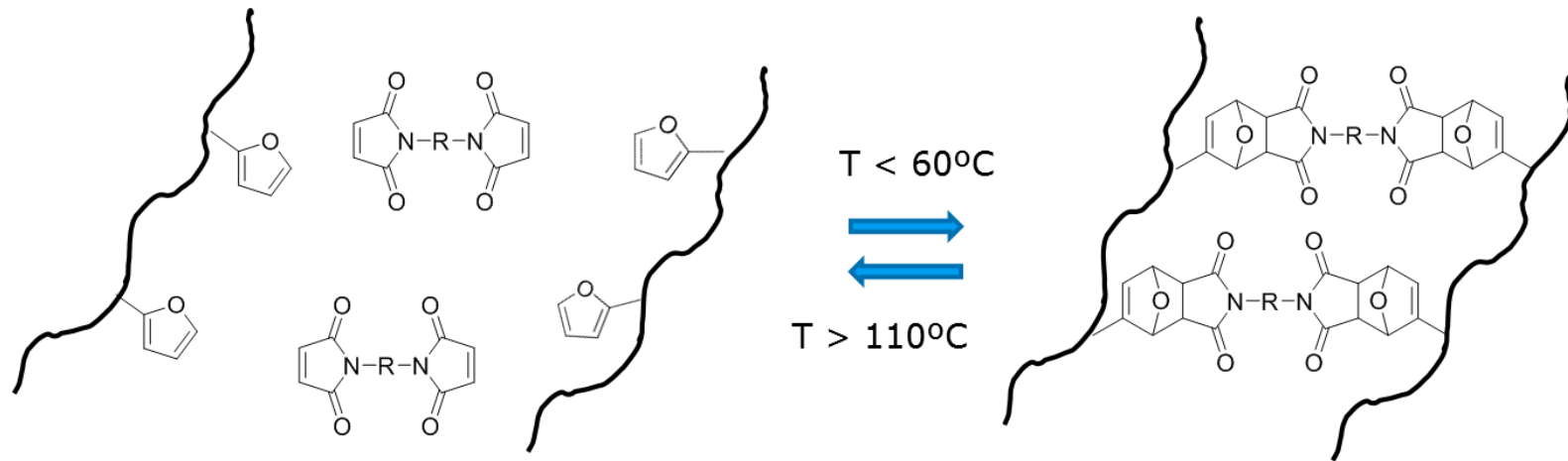
For smart materials





# Amphiphilic Polymers

For smart materials



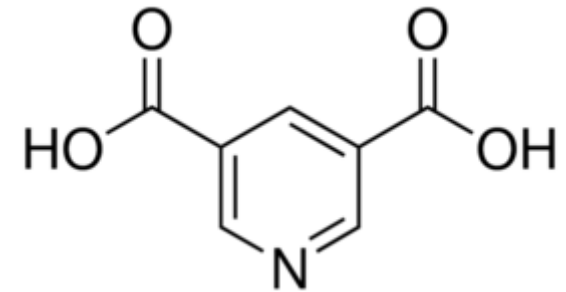
Reversible smart hydrogels

- Drug delivery
- Tissue eng



# Anti-bacterial / anti-stain coatings

Co-supervised by Prof. Cor Koning, DSM (Covestro)



Cationically charged polyesters  PU dispersions



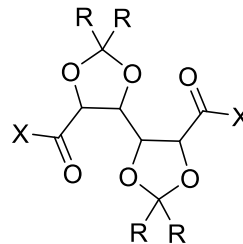
# Bio-Based materials

From sugar industry side stream

Co-supervised by Cor Koning, DSM (Covestro)  
In collaboration with Royal Cosun



Building blocks



aminoacids



Bio-degradable coatings



Example applications:  
Crop protection  
Controlled release fertilizers

For people with good taste in music  
PhD supervisor: Jesse Jongstra



# Bio-Based materials

## From starch

1. In  $scCO_2$



2. With fatty acid derivatives

Hydrophobically modified  
(coatings, adhesives, emulsifiers)

For people with “samurai” powers  
PhD supervisor: Mattia Lenti  
Collaboration with Dynaplak

Cross-linked coatings

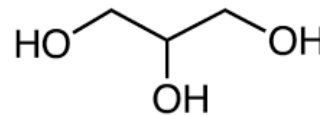
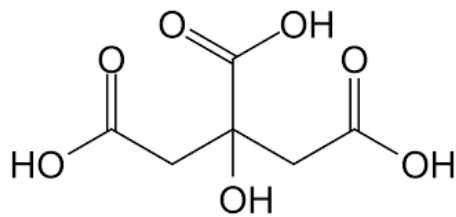
Co-supervised by Cor Koning  
Collaboration with AVEBE



# Bio-Based materials

For super adsorbent polymers

Co-supervised by Cor Koning, DSM (Covestro)



Biodiesel byproduct