Synthesis and dynamics of double networks based on slide-ring materials

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Biography

- From Trinidad and Tobago (English-speaking Caribbean)
- BSc. in Chemistry in Metz and MSc. in Polymer Systems Engineering in Lille
- Internship at University of Lille and Dow Silicones Belgium - experience in synthesis and rheology
- Recruited to DoDyNet in June 2018

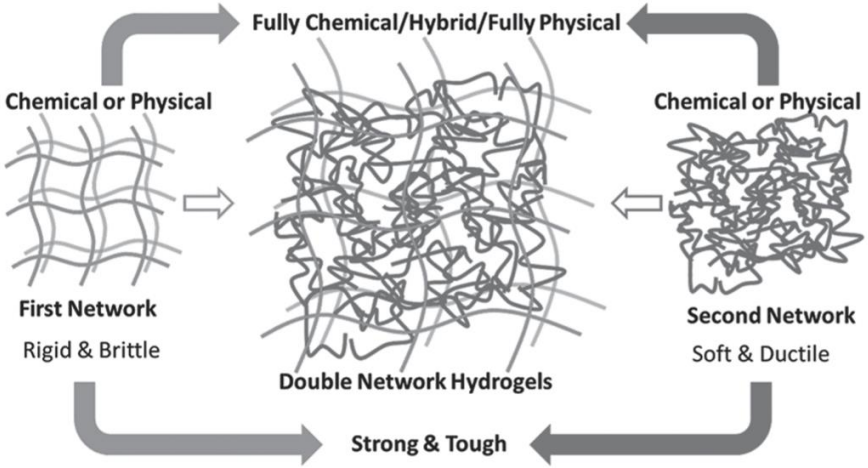
Project Summary

What is my role?

- Synthesis of Double Dynamics Networks (DDN) - Double Dynamics Slide Ring Gels
- Characterisation by linear and extensional rheology
- Distribution of samples to DoDyNet network

Double Networks

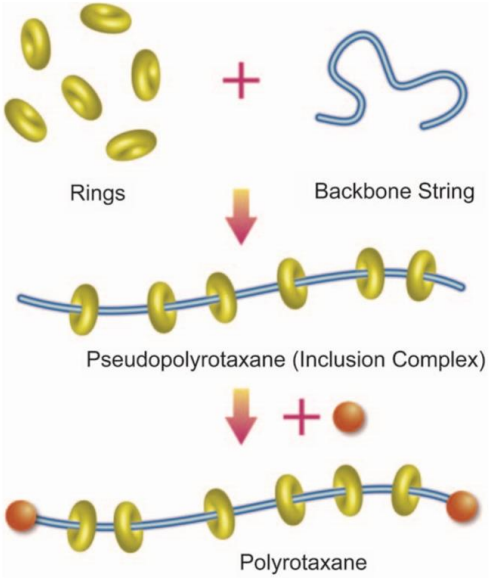
- Made of first network and second network
- Can be fully chemical, fully physical or hybrid
- Strong mechanical properties as a result of interactions between two networks



Macromol. Chem. Phys. 2016, 217, 1022−1036,
WILEY-VCH Verlag GmbH & Co

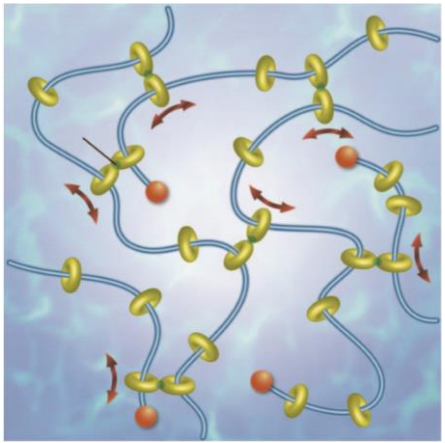
Polyrotaxanes & Slide Ring Materials, 2016, Chapter 1 p 1-10, RSC

Slide Ring Gels



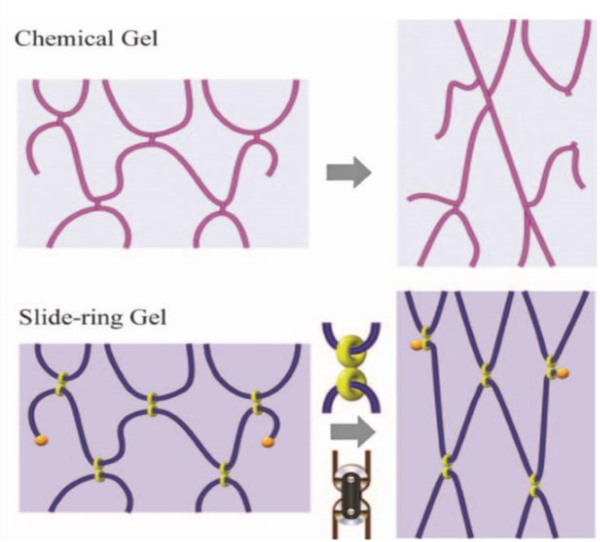
Crosslinker

Mechanical interlocking of cyclodextrin to form movable “figure-of-eight” rings



Polyrotaxanes & Slide Ring Materials, 2016, Chapter 1 p 1-10, RSC

Slide Ring Gels



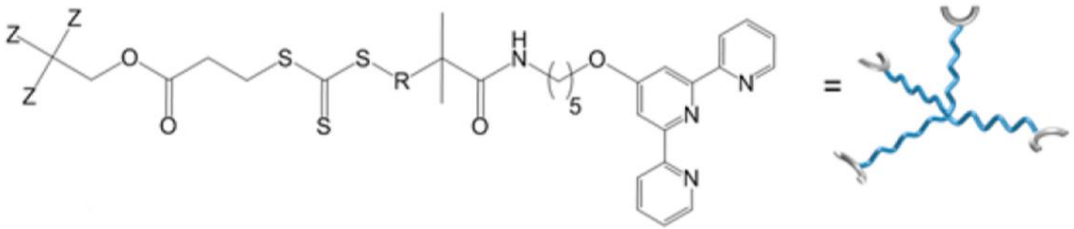
Advantages:

- Resistant to tensile deformation
- Can be crosslinked with conventional elastomers/resins
- Biocompatible with PEO and cyclodextrin precursors

Macromolecules 2017, 50, 5165−5175

Synthesis Steps

1. Synthesis of telechelic star polymers with terpyridine functionality

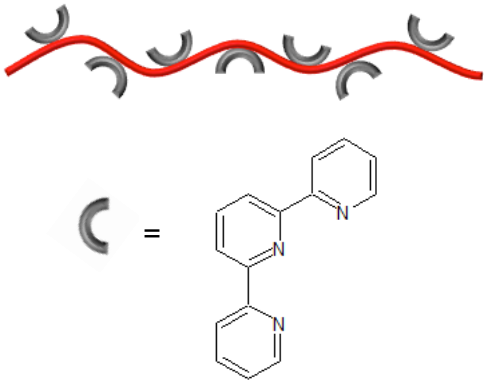


Controlled radical polymerisation (RAFT):

Poly(n-butylacrylate) (PnBA) in melt
Poly(dimethylacrylamide) in solution

Synthesis Steps

2. Synthesis of long linear functionalised copolymers

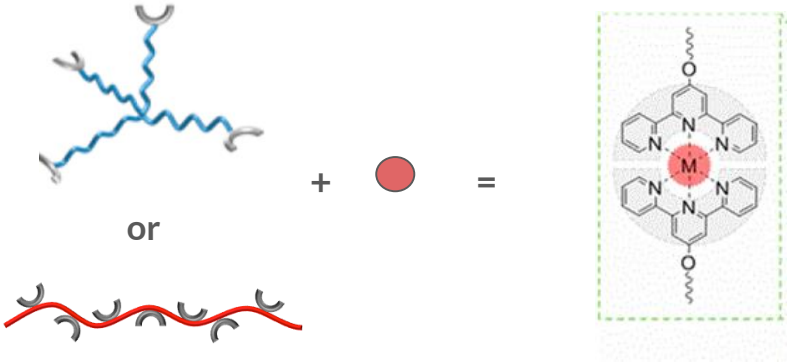


Acrylate or acrylamide based copolymers with tpy side groups

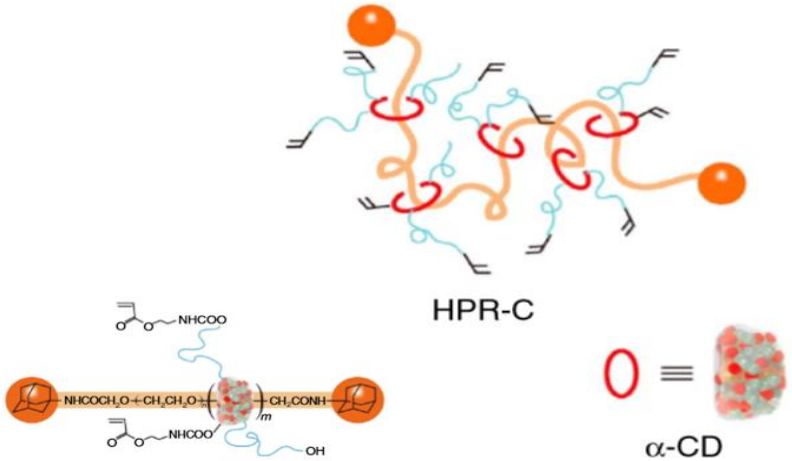
Macromolecules 2017, 50, 5165−5175
Nature Communications volume 5, Article number: 5124 (2014)

Synthesis Steps

3. Synthesis of slide ring DDN



First network - Metal-terpyridine links



Second network - Slide ring crosslinks

Perspectives

- Many aspects of final polymer can be controlled:
  - Amount of metal-ligand precursor
  - Amount of Polyrotaxane crosslinker
  - Reaction Conditions
- Characterisation to establish:
  - Effect of both reaction and environmental conditions (temperature, pH) on polymer rheology
  - Viscoelastic properties of both single and double networks

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Questions?

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