Synthesis and Characterization of Foldamer-Based Polymer Networks.

Lobnan Mazloum¹, Ivan Huc², Charles-André Fustin¹

¹UCLouvain, Institute of Condensed Matter and Nanoscience - Bio and Soft Matter division (IMCN-BSMA), 1348 Louvain-la-Neuve, Belgium

²LMU, Department of Pharmacy and Center for Integrated Protein Science, 81377 München, Germany

Introduction

SASRIN resir

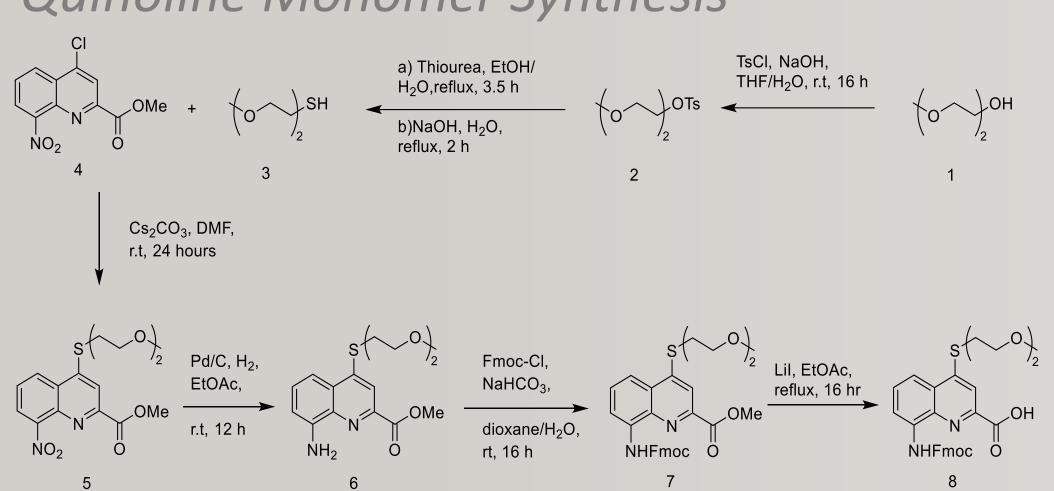


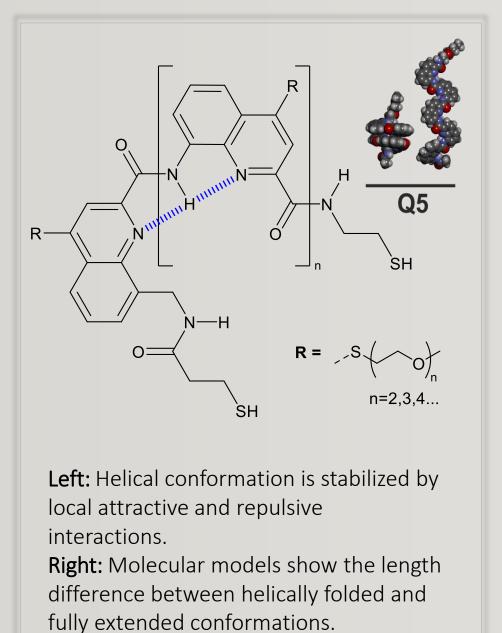


Proteins fold into complex 3D structures with unique mechanical properties, such as titin's elasticity.[1] Smaller artificial analogs, called foldamers, can undergo fully reversible conformational changes under force by breaking and reforming weak intra-helix bonds.^[2,3] Aromatic oligoamide foldamers made from 8-amino-2-quinolinecarboxylic acid show exceptional elasticity, reversibly extending up to 3.8 times their original length and fully refolding afterward.[4] This project aims to incorporate these foldamers into polymer networks of different topologies to study their effects on the rheological and mechanical properties of gels.

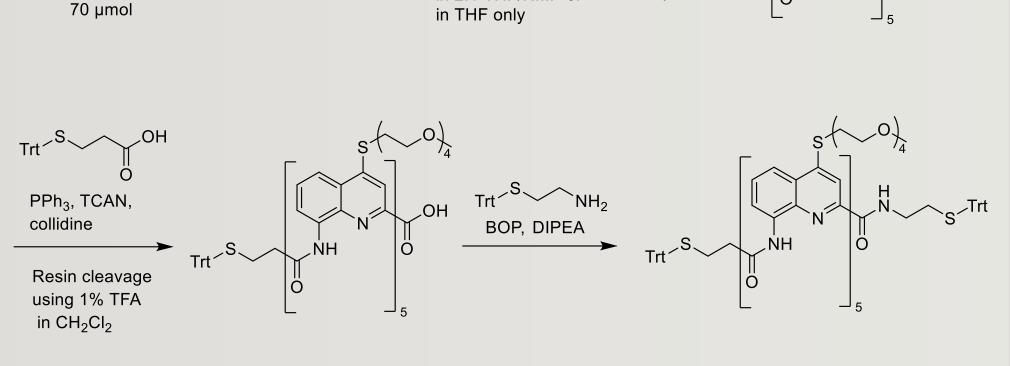
Foldamer Synthesis

Quinoline Monomer Synthesis



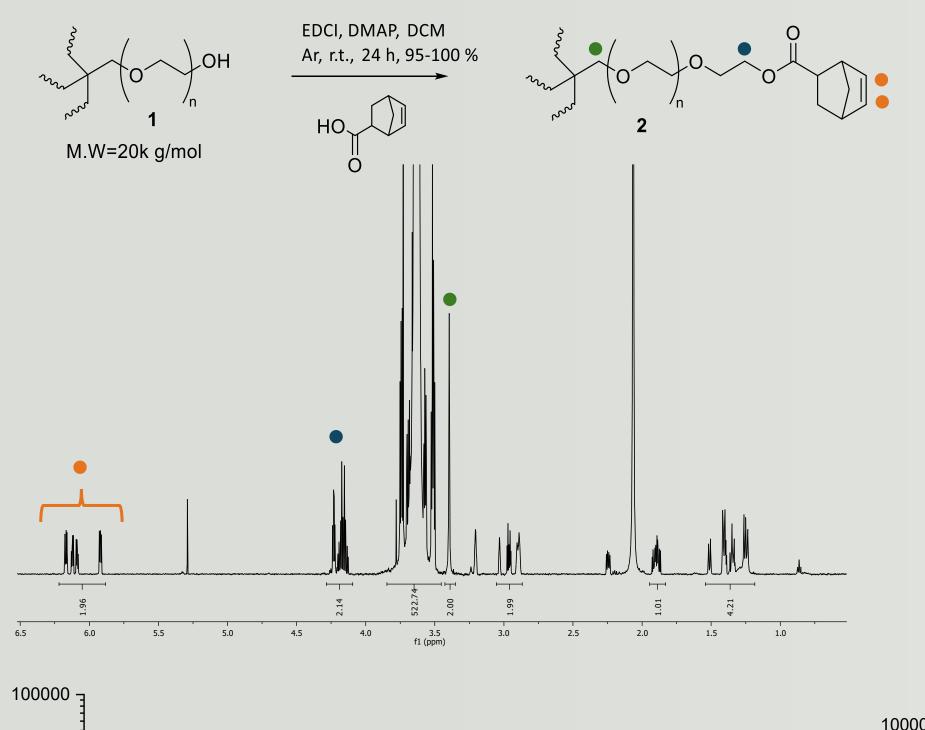


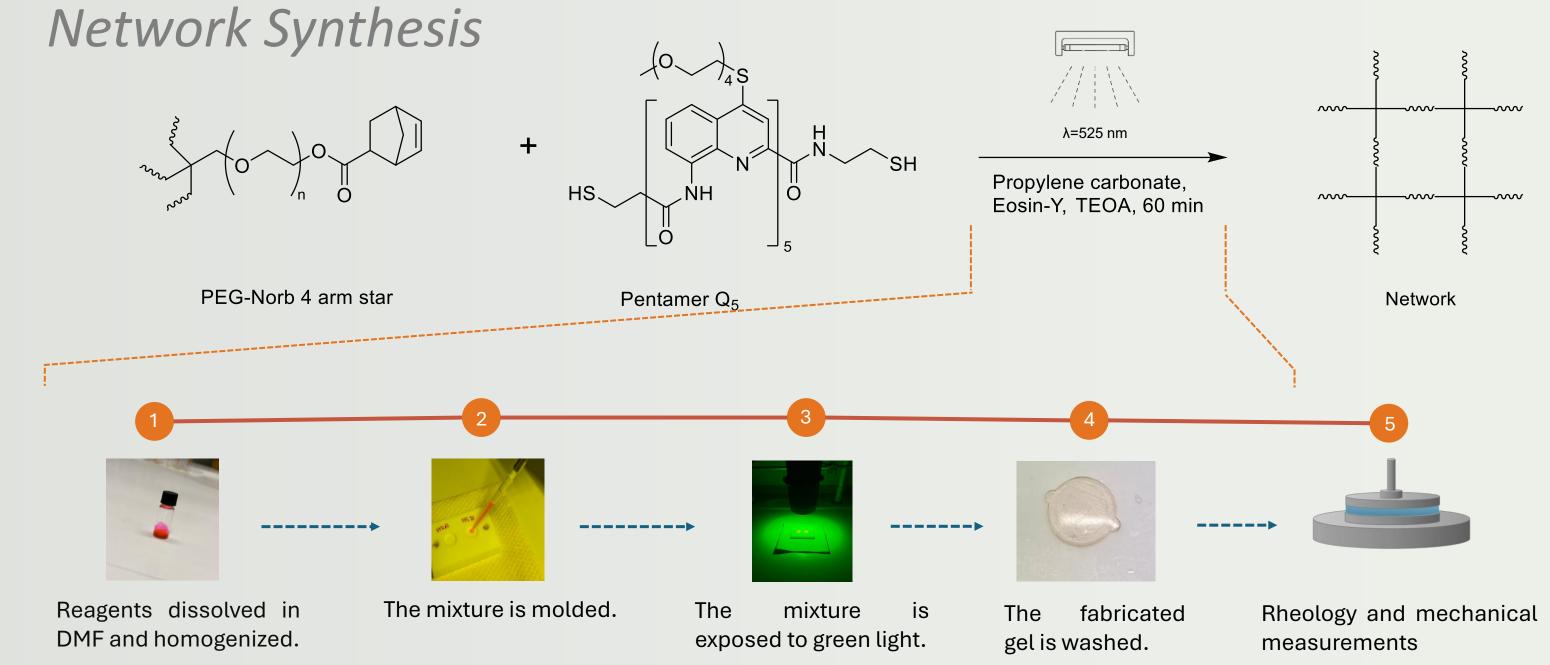
Foldamer Solid Phase Assembly



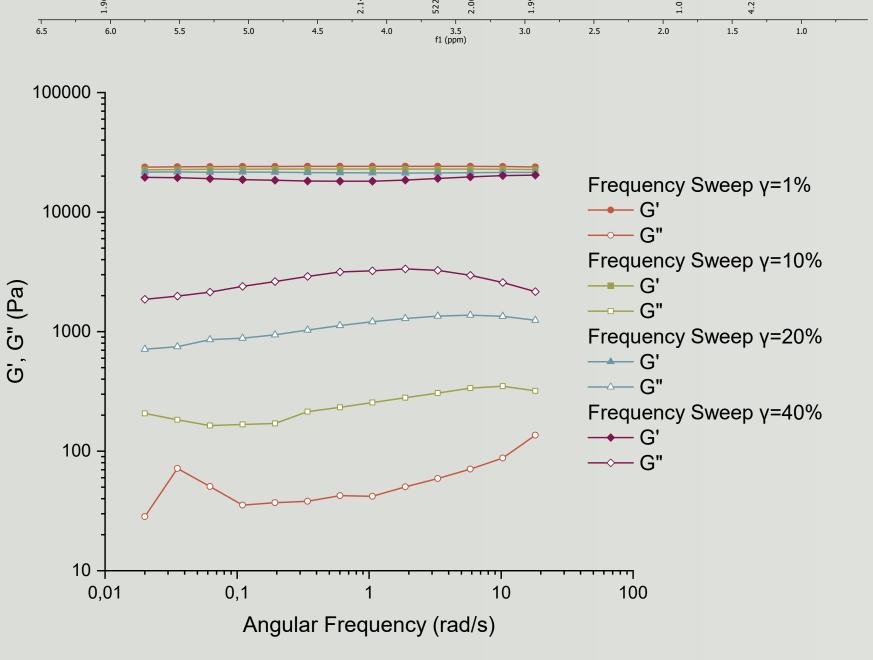
Topology 1: "Ideal" Star Network

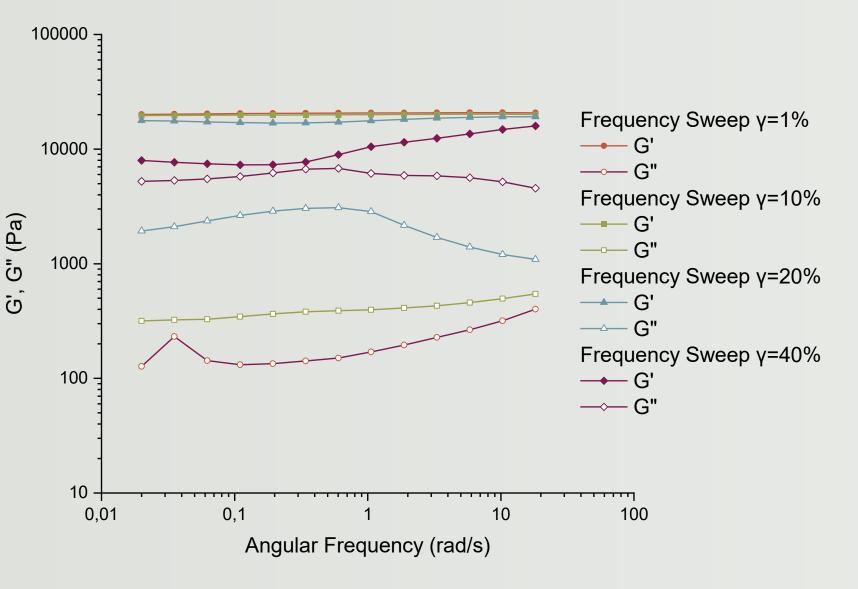
4-arm star Functionalization

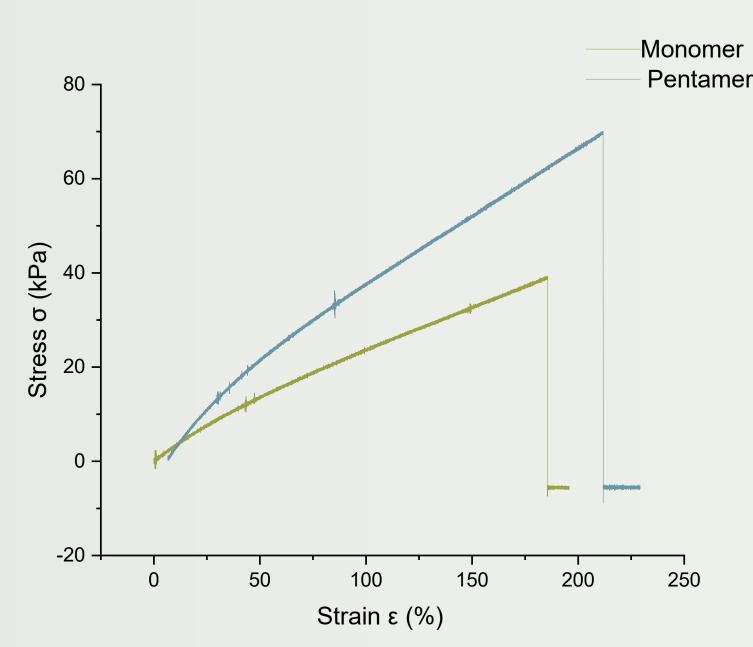




- The thiol-ene reaction used norbornene-PEG and the pentamer under 60 min irradiation at 20% polymer concentration.
- Eosin-Y was chosen for its higher absorbance than the foldamer.



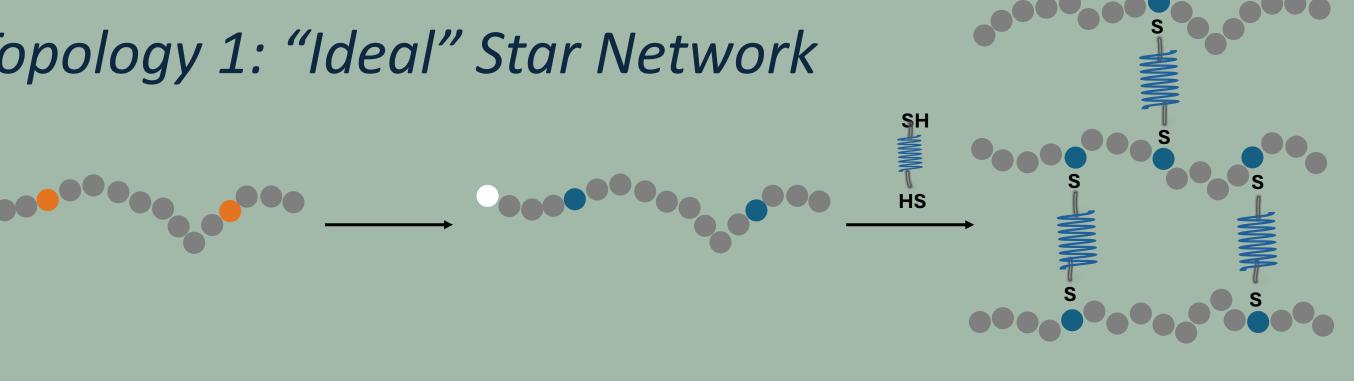


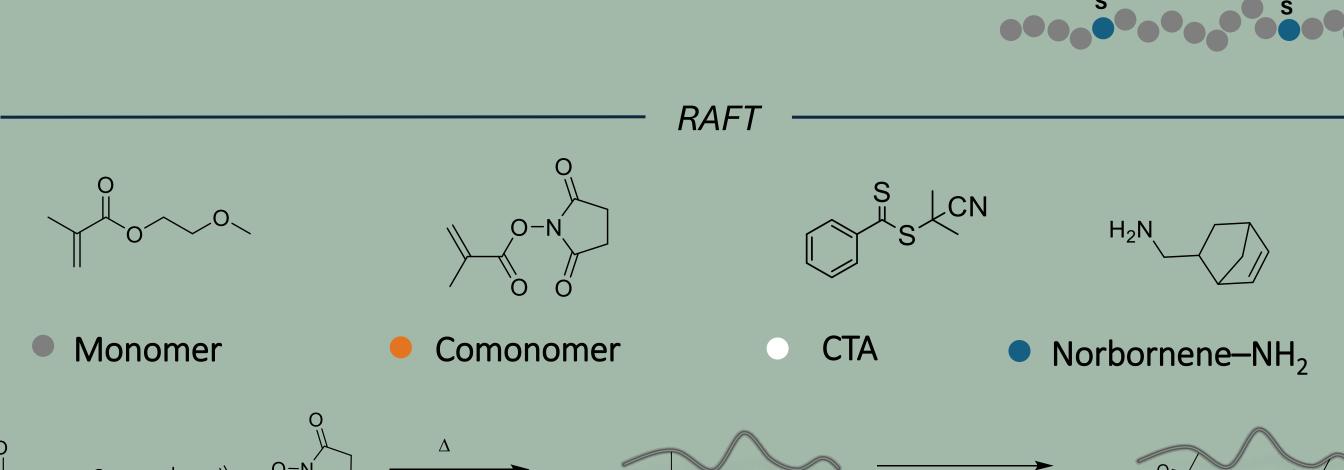


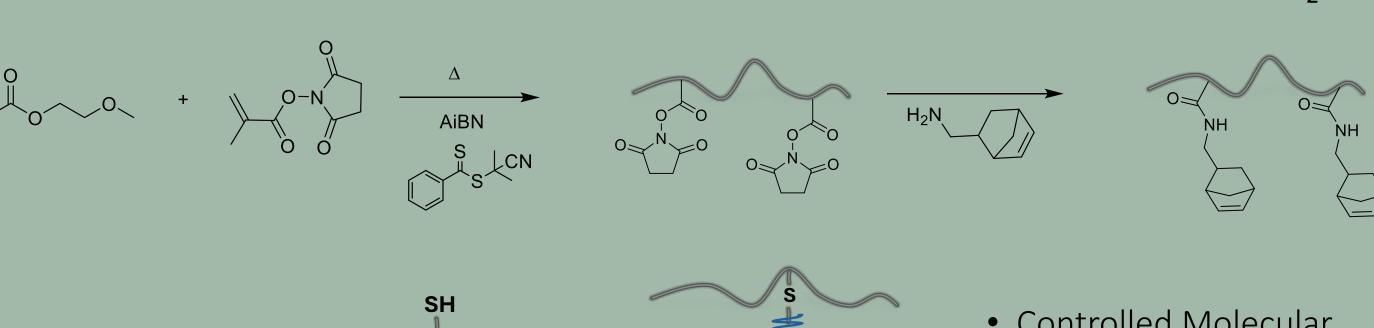
Frequency Sweeps: Pentamer Q5crosslinked gels

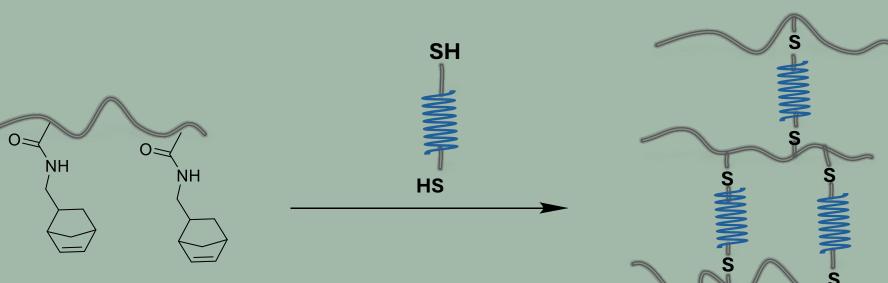
- Frequency Sweeps : Monomer Q1crosslinked gels
- Tensile tests: Stress-Strain curve

Topology 1: "Ideal" Star Network









- Controlled Molecular Weight
- Similar reactivities between the monomers

Conclusions

- 4-arm PEG was functionalized with norbornene for thiol—ene click coupling with thiol-functionalized foldamers.
- Gels formed under 525 nm light with Eosin-Y using both monomer and pentamer foldamers, confirming efficient crosslinking.
- Gels with pentamers showed higher modulus, elasticity, and strength than those with monomers.
- Linear polymers will be crosslinked with foldamers to form a new gel architecture.

Related literature

- (1) J. Wu, P. Li, C. Dong, H. Jiang, B. Xue, X. Gao, M. Qin, W. B. Chen, Y. Cao, *Nature Commun.* **2018**, *9*, 620. Wang,
- (2) G. Guichard, I. Huc, Chem. Commun. 2011, 47, 5933.
- (3) E. Yashima, N. Ousaka, D. Taura, K. Shimomura, T. Ikai, K. Maeda, Chem. Rev. 2016, 116, 13752.
- (4) F. Devaux, X. Li, D. Sluysmans, V. Maurizot, E. Bakalis, F. Zerbetto, I. Huc, A.S. Duwez, *Chem* **2021**, *7*, 1333.

Acknowledgement

This work was supported by PDR FNRS T.0087.22