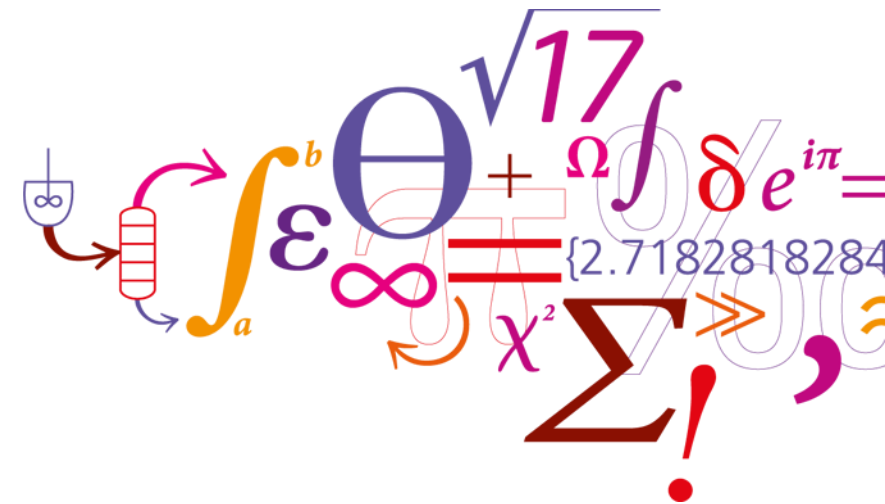


Viscoelastic Response of Double Dynamics Polymer Networks under Transient Elongation

Intermediate Meeting I

ESR 6: Wendi Wang
 Supervisor: Qian Huang
 Anne Ladegaard Skov
 Ole Hassager



Outline

- About me
- Project plan
- Current work

About me



**Technical University of Denmark,
1st June, 2018 –**

PhD candidate in Department of Chemical
Engineering



About me



ESPCI PARIS ★ Paris
ESPCI Paris, 2014 – 2016
 Master on Physical-chemistry

MINES ParisTech ★ Sophia Antipolis
MINES ParisTech, 2016 – 2017
 Advanced master on Materials, Processing and Modeling




Fudan University, 2010 – 2014
 B.Sc. on Macromolecular Materials and Engineering



Project plan

- Study the nonlinear extensional behavior of the model DDNs as a function of their composition

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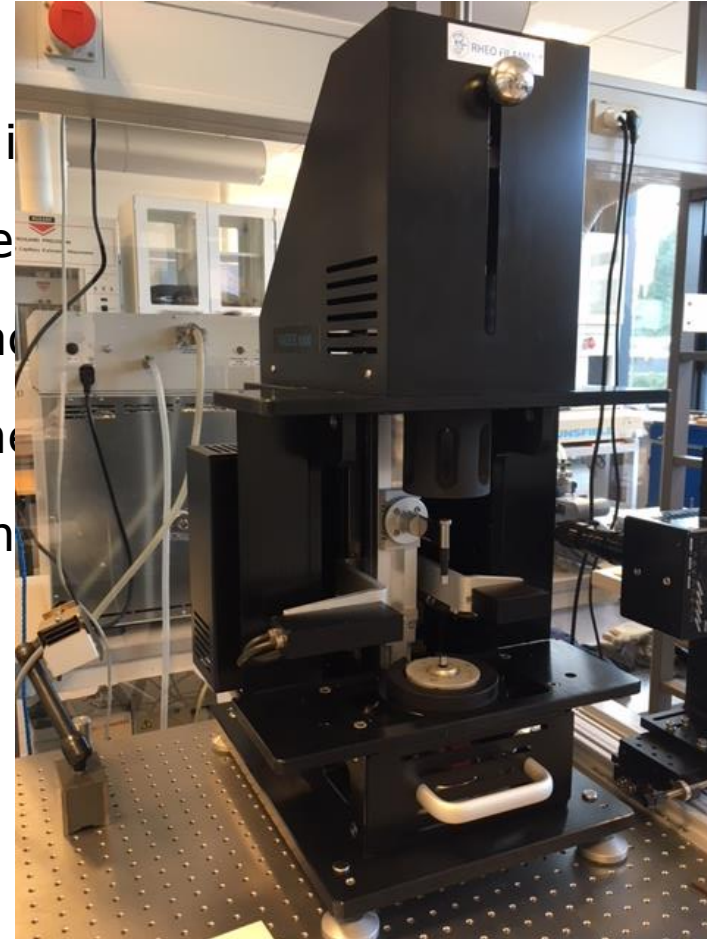
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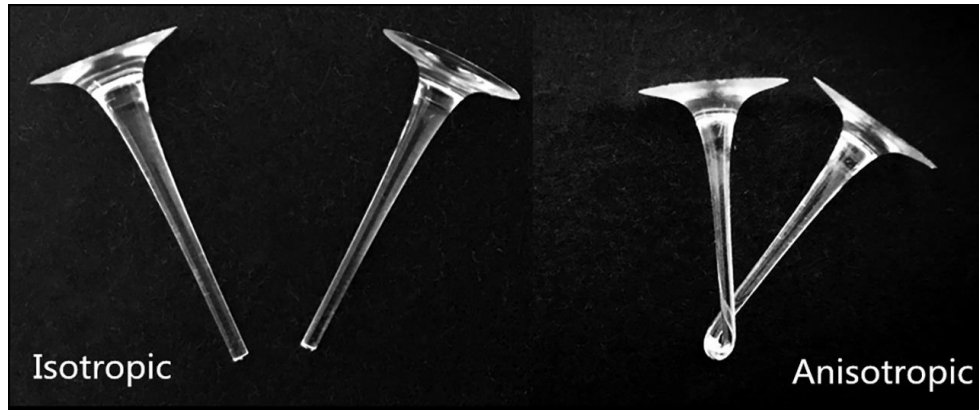
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Current work – Rheological and mechanical properties of polystyrene with hydrogen bonding



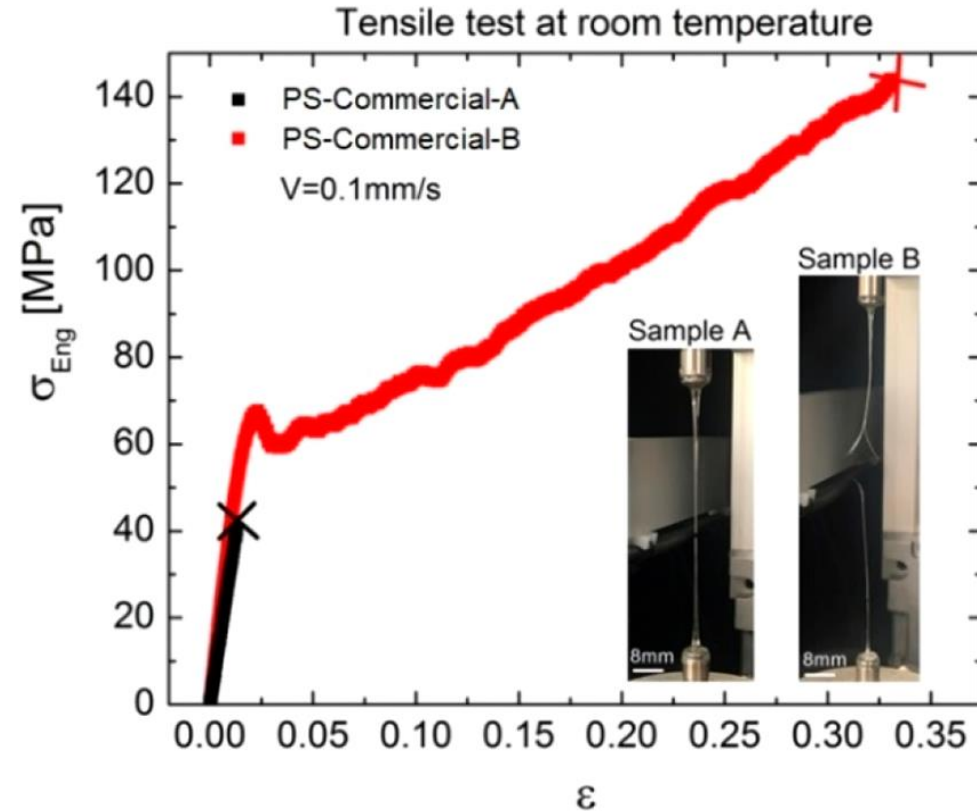
How these two samples are obtained?

- Sample A: slowly stretched (fully relaxed)
- Sample B: fast stretching (inverse Rouse time) + immediate fast quenching

Qian Huang et al. *ACS Macro Lett.* 2018, 7, 1126-1130

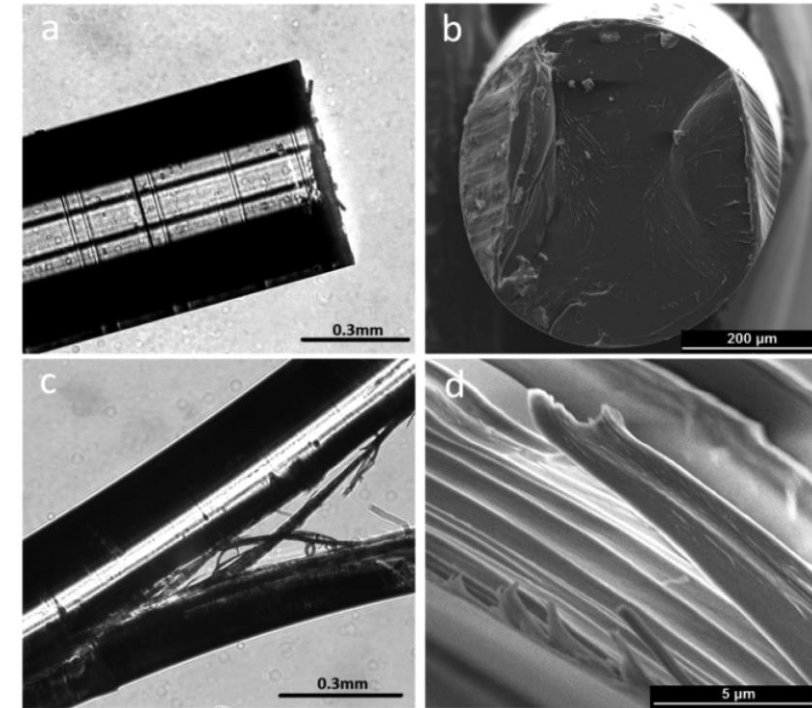


Background



Engineering stress as a function of strain in tensile tests at room temperature

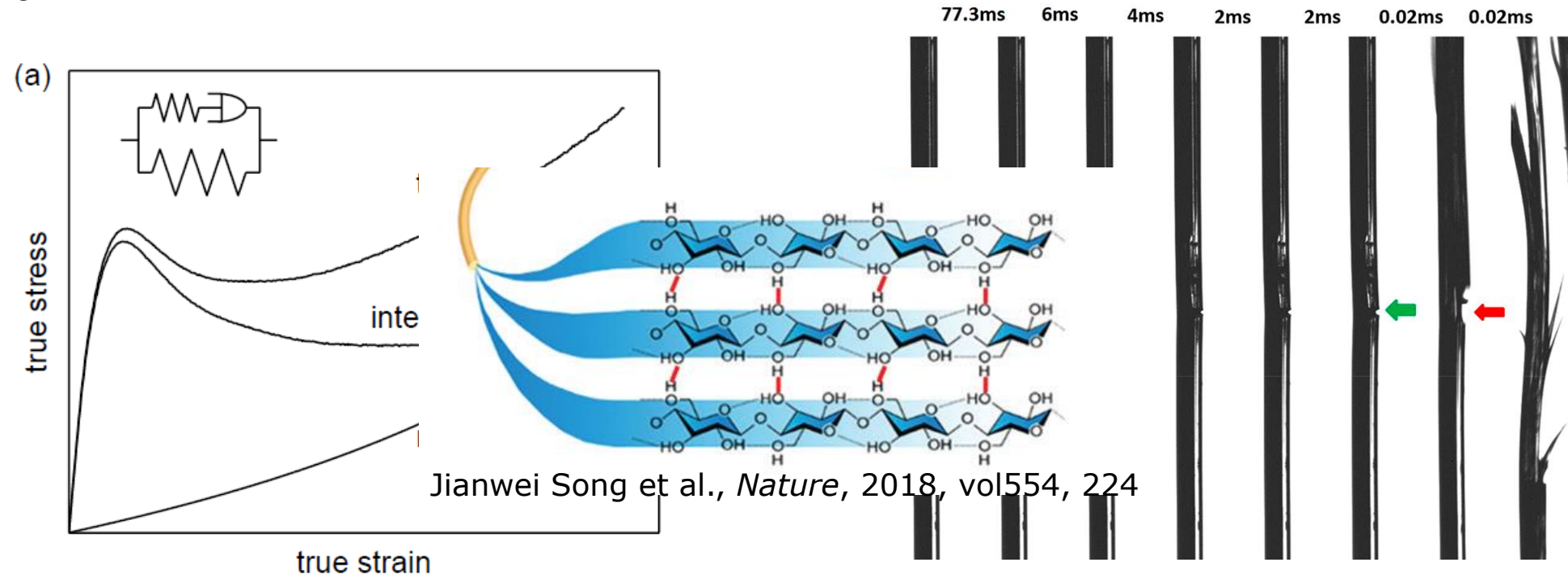
Qian Huang et al. *ACS Macro Lett.* 2018, 7, 1126-1130



(a) Optical microscopy image and (b) SEM image for the brittle sample PS-Commercial-A; (c) Optical microscopy image and (d) SEM image for the flexible sample PS-Commercial-B

Origin ?

- Loss of strain localization due to enhanced stress contribution from the prestretched network
- Chain sliding present in flexible PS



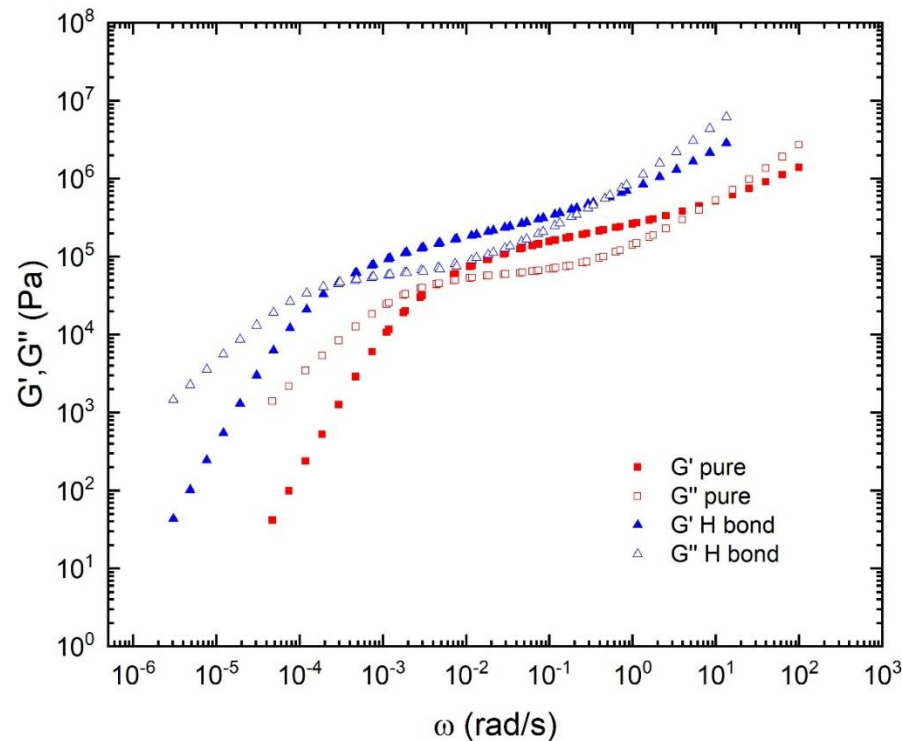
H.E.H. Meijer, L.E. Govaert, *Prog. Polym. Sci.* 2005, 30, 915–938

Qian Huang et al. *ACS Macro Lett.* 2018, 7, 1126–1130

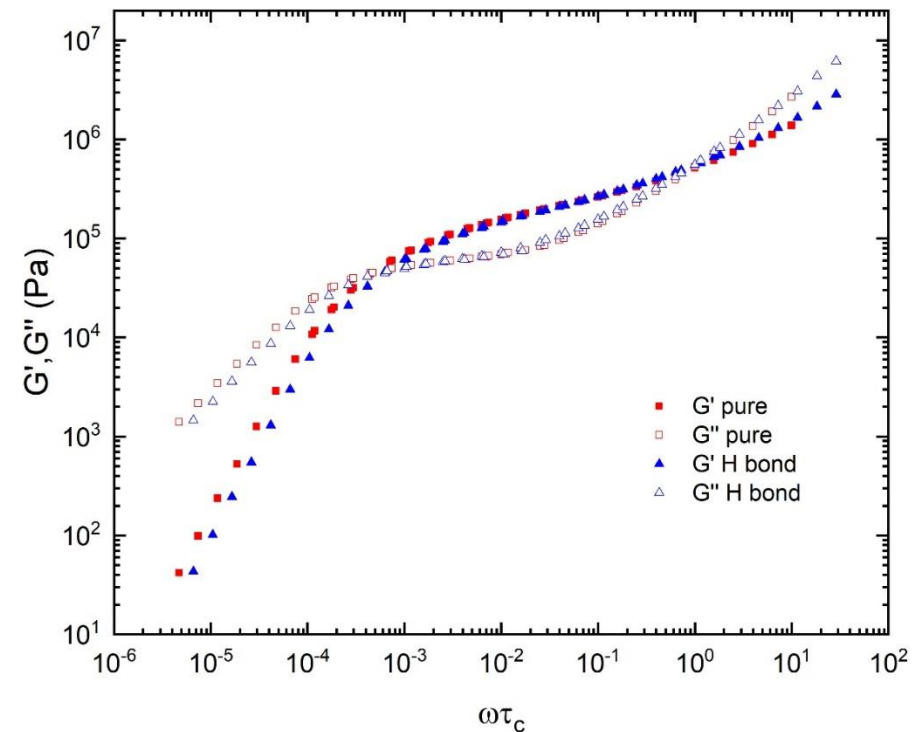
Strategy

Two PS based sample $M_w = 100\,000\text{ g/mol}$

Sample 1: Pure PS, $T_g = 100^\circ\text{C}$; **Sample 2:** PS backbone with 5% acid group, $T_g = 114^\circ\text{C}$



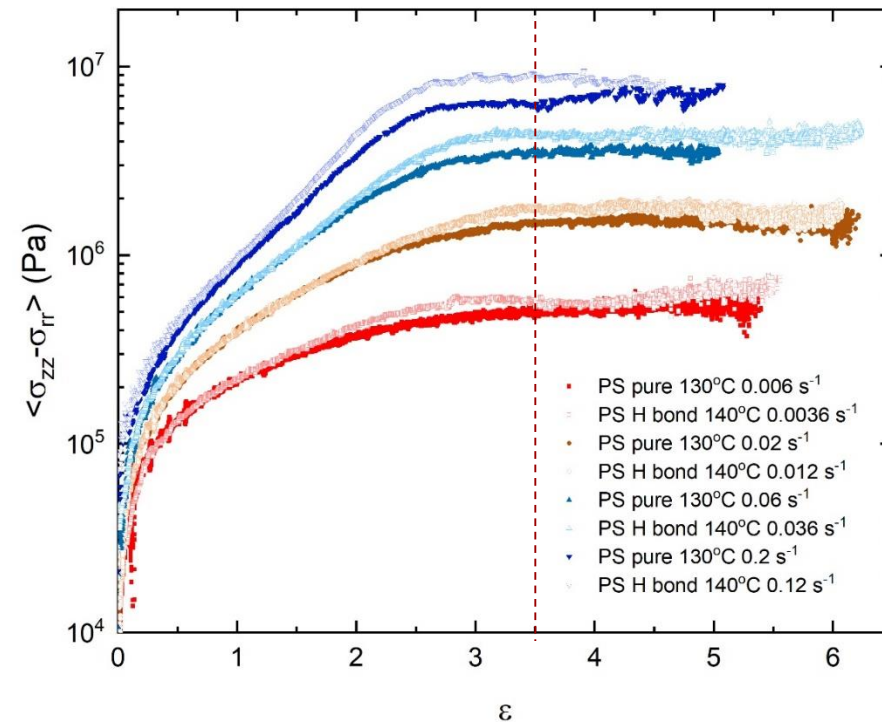
LVE data at 130°C (for PS hydrogen bonding sample, its master curve is built at 140°C then shifted to 130°C)



LVE data with normalized frequency at 130°C

Rheological property

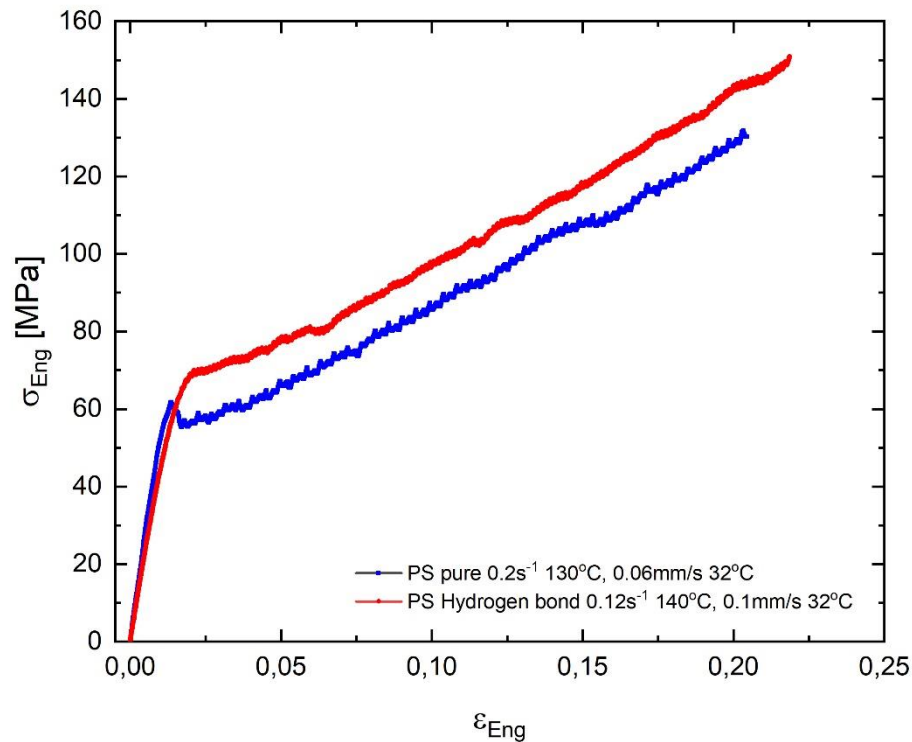
- Non linear extensional behaviour



Comparison of extensional stress as a function of Hencky strain for two PS samples

Mechanical property

- Tensile test



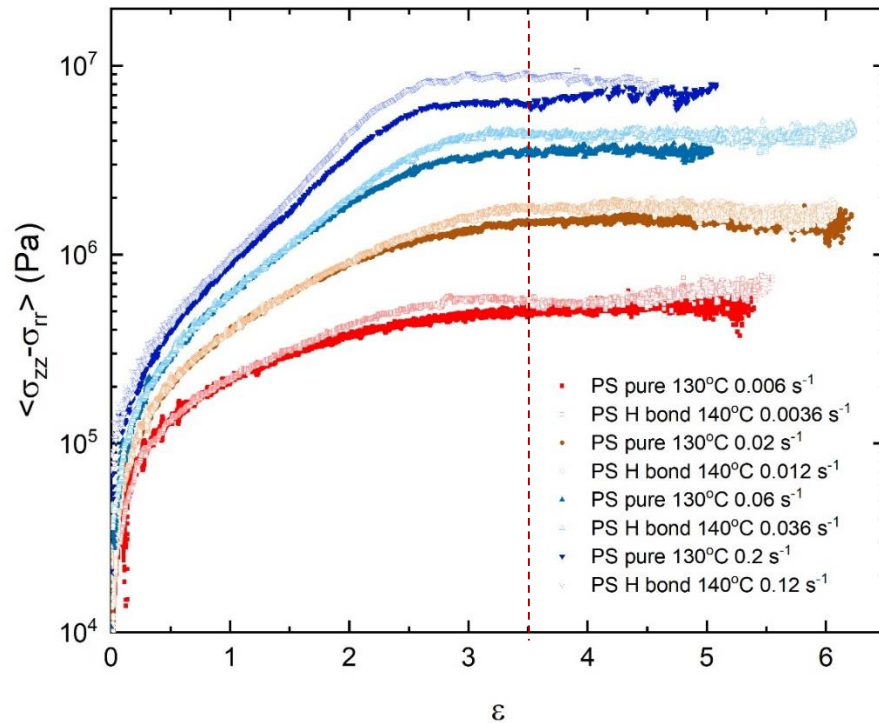
- Future work

- Check repeatability
- Tests on full relaxed samples
- Tests on sample with a higher hydrogen bonding proportion

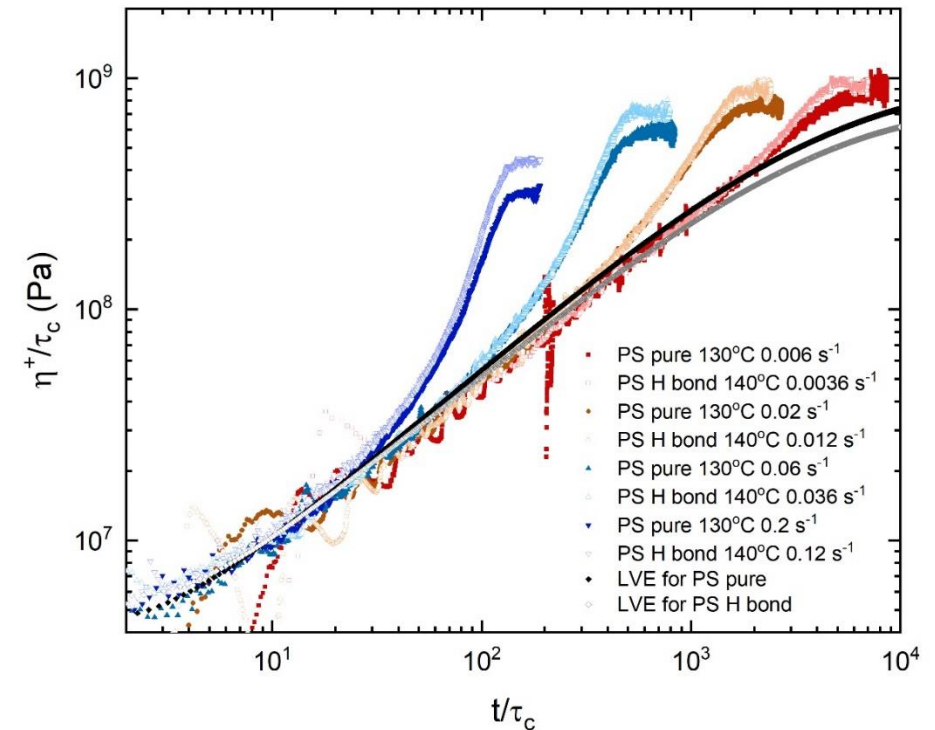


Rheological property

- Non linear extensional behaviour



Comparison of extensional stress as a function of Hencky strain for two PS samples



Comparison of normalized extensional stress growth coefficient for two PS samples