

DTU, May 2019

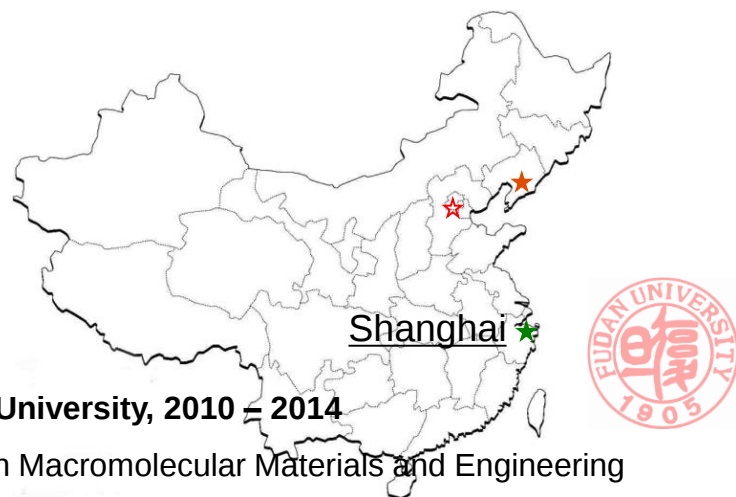
Viscoelastic Response of Double Dynamics Polymer Networks under Transient Elongation

ESR 6: Wendi Wang

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Anne Ladegaard Skov
Ole Hassager

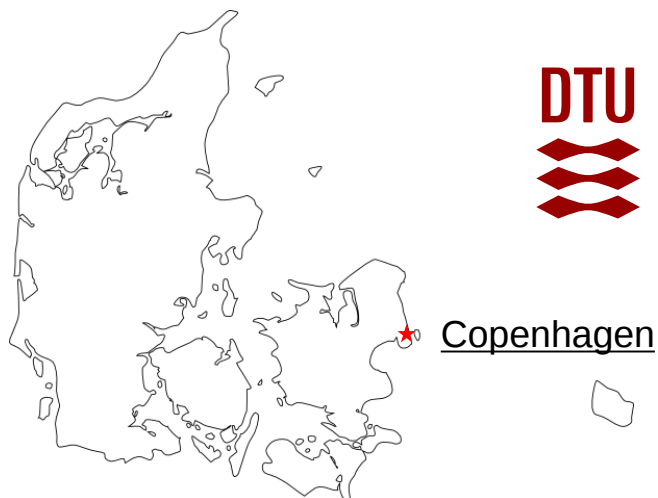


Education background



Fudan University, 2010 – 2014

B.Sc. on Macromolecular Materials and Engineering



Copenhagen



ESPCI Paris, 2014 – 2016

Master on Physical-chemistry

MINES ParisTech, 2016 – 2017

Advanced master on Materials, Processing and Modeling

Technical University of Denmark, 1st June, 2018 – 31st May, 2021

PhD candidate in Department of Chemical Engineering

Objective

ESR6: Viscoelastic Response of Double Dynamics Polymer Networks under Transient Elongation

- Study the nonlinear extensional rheology of different Double Dynamics Networks (DDNs)
- Relate the rheological results to mechanical properties towards applications

- Current work:

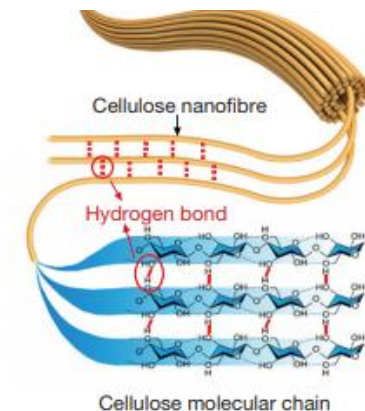
Rheological and mechanical properties of polystyrene with hydrogen bonding



Flexible polystyrene



Cracks when trying to recover the sample after bending



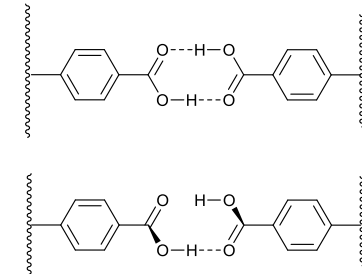
Jianwei Song et al., *Nature*, 2018, vol 554, 224

Methodology

Material:

Three PS based sample

Sample	Mn(g/mol)	Mw(g/mol)	$\bar{D}$	Tg (°C)
PS pure	86 k	142 k	1.65	100
PS 5% acid	92 k	122 k	1.33	114
PS 9% acid	94 k	116 k	1.23	122



Characterizations:

Linear viscoelastic properties



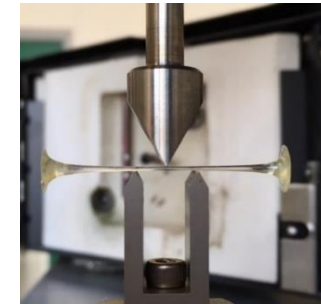
Nonlinear extensional properties



Tensile test

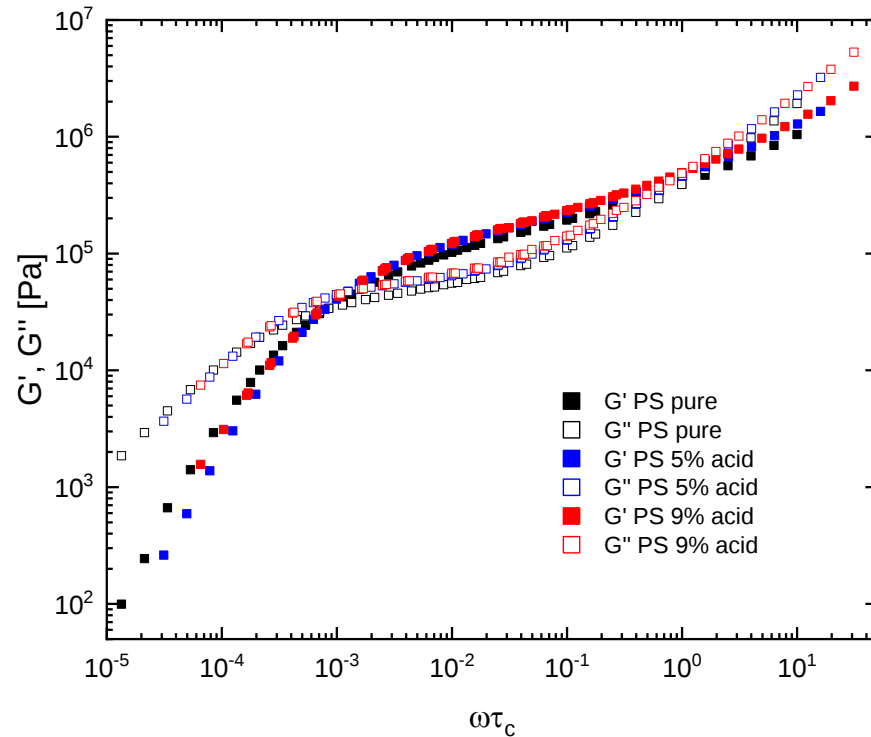


Three-point bending test



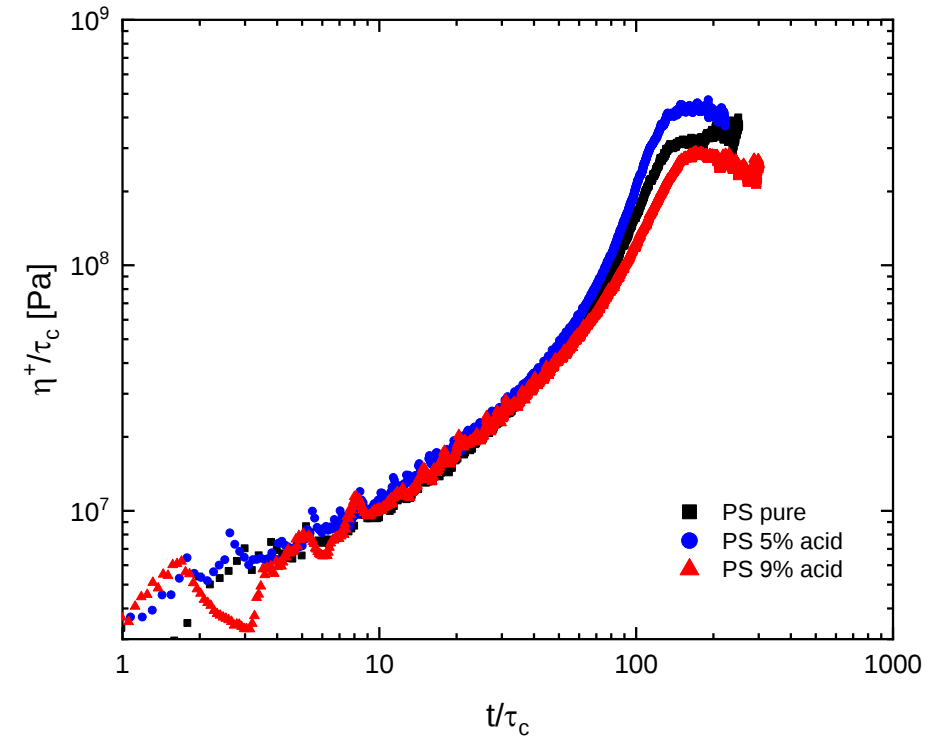
Results

- Small Amplitude Oscillatory Shear (SAOS)



LVE data with normalized frequency at 150°C

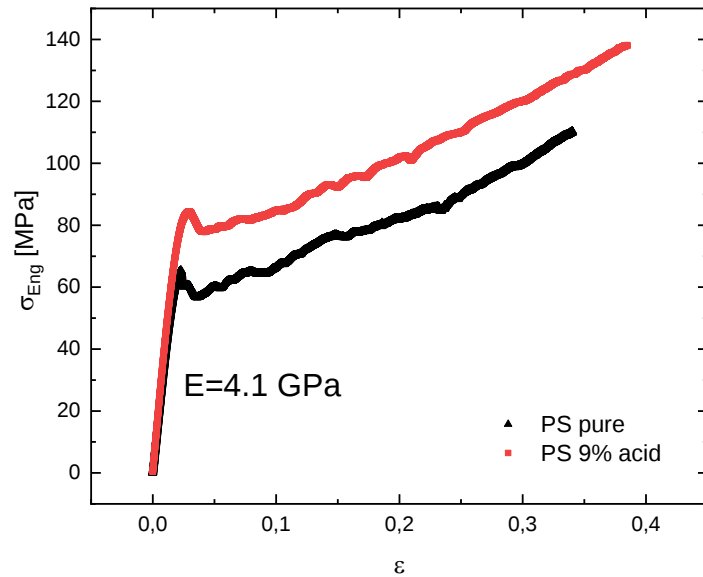
- Filament stretching at constant rate



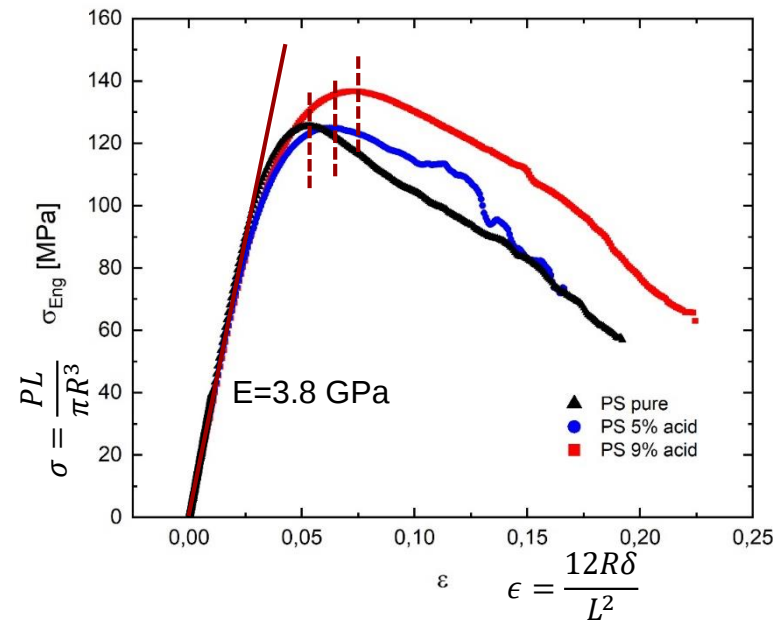
Comparison of normalized extensional stress growth coefficient for three samples

Results

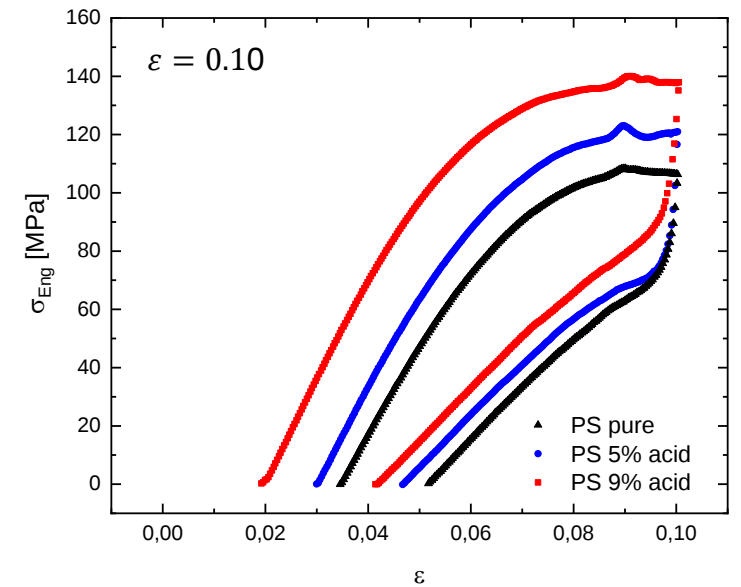
- Tensile test
- Three-point bending test



Engineering stress as a function of strain in tensile tests at room temperature, with a strain rate 0.001 s^{-1}



3-point bending test on different samples at room temperature: Sample is stretched to $\epsilon=3.5$ at melt state followed by fast quenching to RT.



Step strain measurements for samples with different acid group contents

Training & Dissemination

- Training

- Rheology of Complex Fluids
- Polymer Physics
- Methods in Soft Materials Science
- SANS experiment at NIST

- Secondments

- UN (G. Ianniruberto) (planned in 2020)
- tesa (planned in 2020)

- Dissemination

- Biweek DPC seminar, December 2018
- DPC Annual Polymer Day, Coloplast, March 2019
- Talk on Annual European Rheology Conference, Slovenia, April 2019



Future career

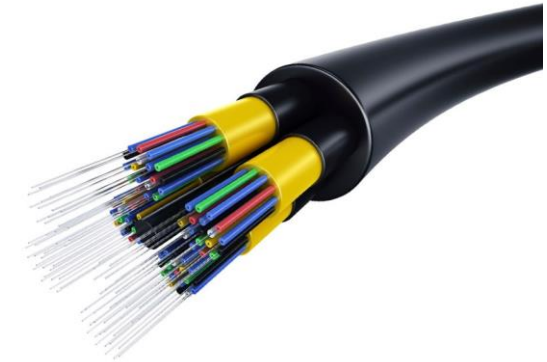
- Continue research work in industrial environment, for example working in the R&D department



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