



Mechanics of Soft Materials

Soft Polymer Network Group

***Laboratory of Soft Matter Science and Engineering
ESPCI-ParisTech, Paris, F
Global station for Soft Matter, Gi-CoRE, U. Hokkaido***



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Laboratory of Soft Matter Science and Engineering

Permanents

Costantino Creton

Tetsuharu Narita

Dominique Hourdet

Yvette Tran

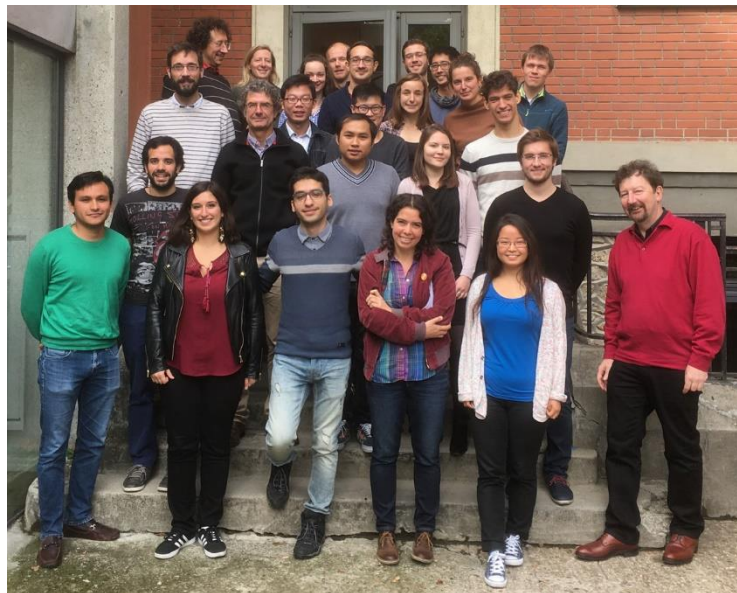
Alba Marcellan

Etienne Barthel

Matteo Ciccotti

Bruno Bresson

Guyline Ducouret



- *Collaborations and exploitation of synergies*
- *Shared equipment*
- *Students and post-docs are jointly advised*

PhD students

Ekkachai Martwong

Jingwen Zhao

Yingjun Chen

Raphaëlle Kulis

Cécile Mussault

Francisco Cedano

Mehdi Vahdati

Anne-Charlotte Le Gulluche

Juliette Sloomman

Ludovic Feige

Paul Fourton

Antoine Fleury

Valentine Hervio

Milena Lama

Giorgia Scetta

Louis Debertrand

Guillaume Votte

Post-Docs

Gabriel Sanoja

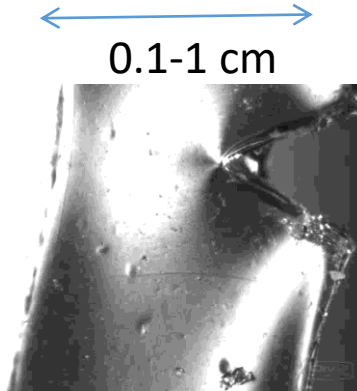
Artem Kovalenko

Josh Yeh

Helen Minsky

Mathilde Tiennot

Xavier Morelle



Physical Mechanics

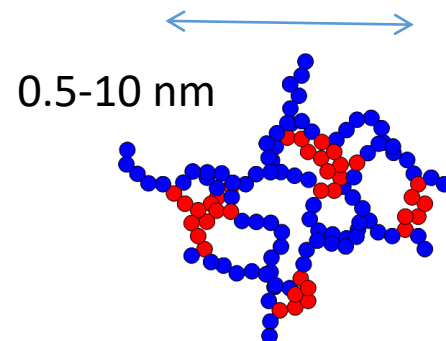
Matteo Ciccotti
Etienne Barthel

Alba Marcellan

Costantino Creton

Design and Properties of New Materials

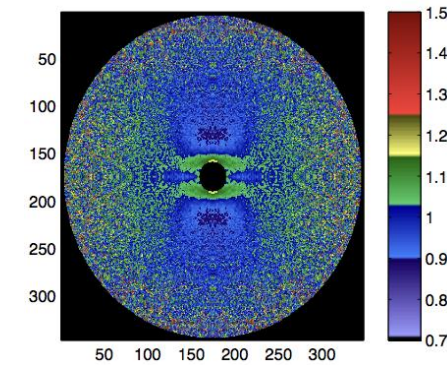
Dominique Hourdet
Yvette Tran



Chemistry
And Phys. Chem.

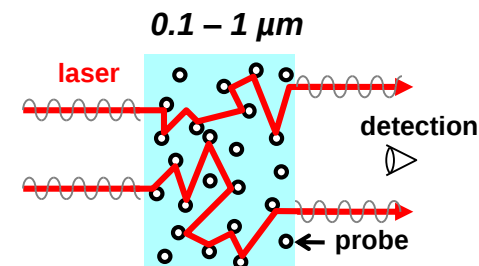
Tetsuharu Narita

Rayons X



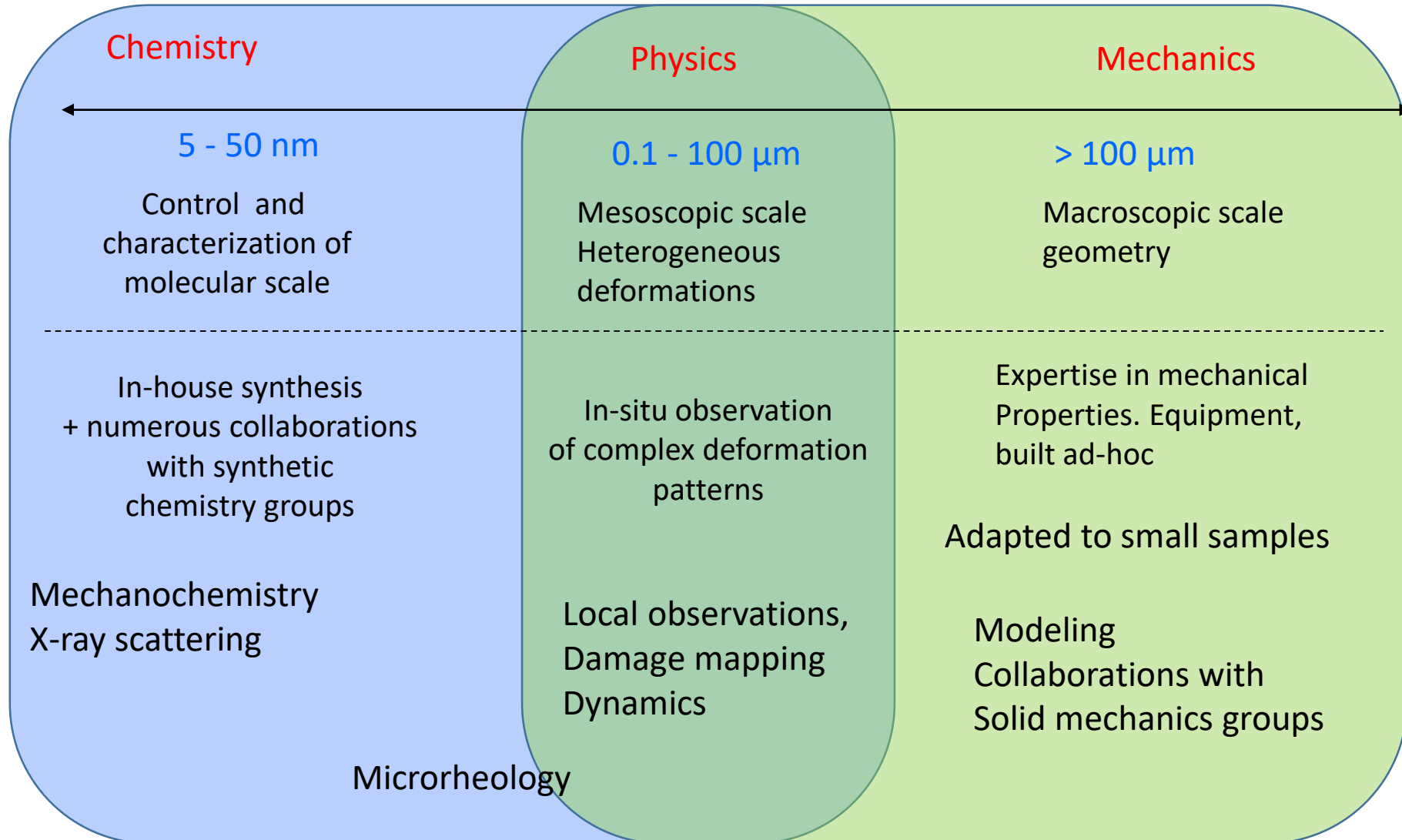
5-100 nm

Scattering techniques
Microrheology
(light, X-ray, neutrons)



Advanced Techniques to Study Advanced Materials

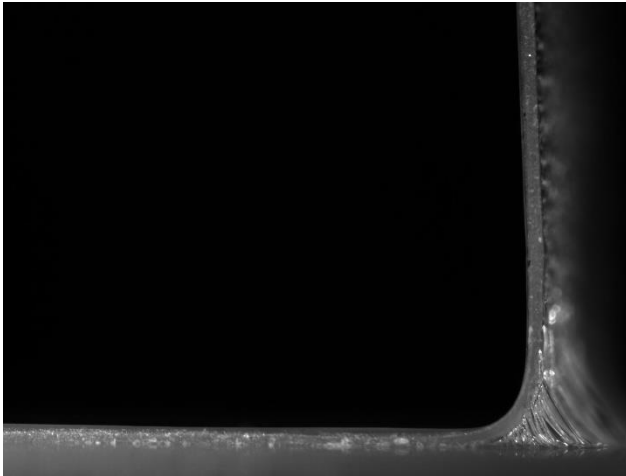
Bridging length scales and disciplines



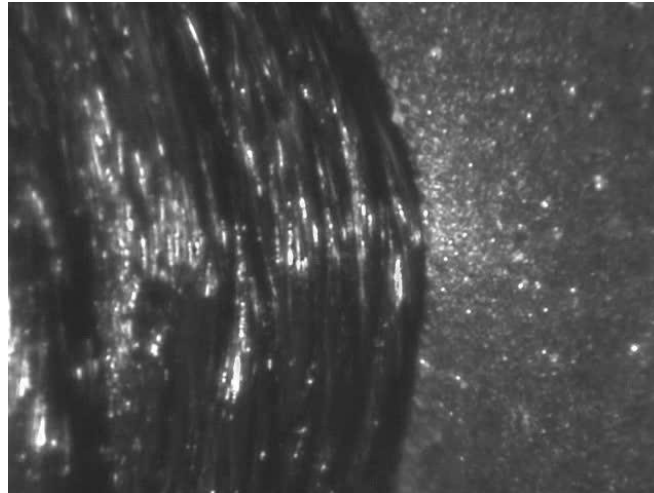
DoDyNet contribution

Materials in Heterogeneous deformations
and in large strain

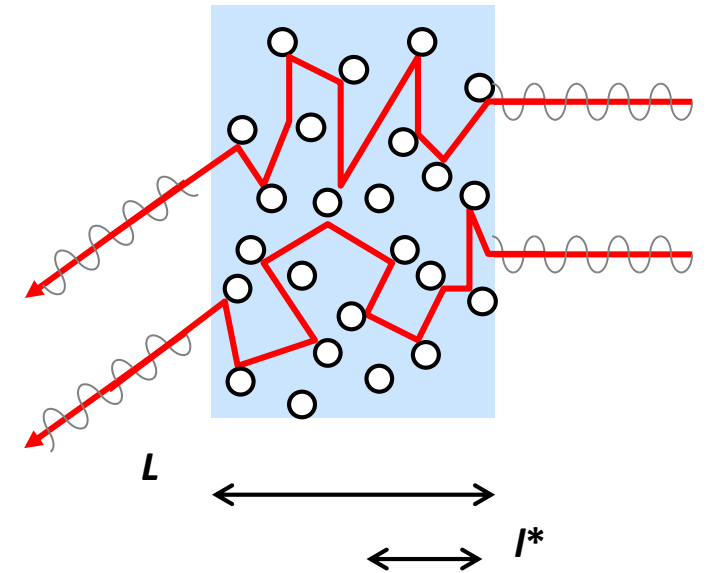
Soft adhesives



Fracture

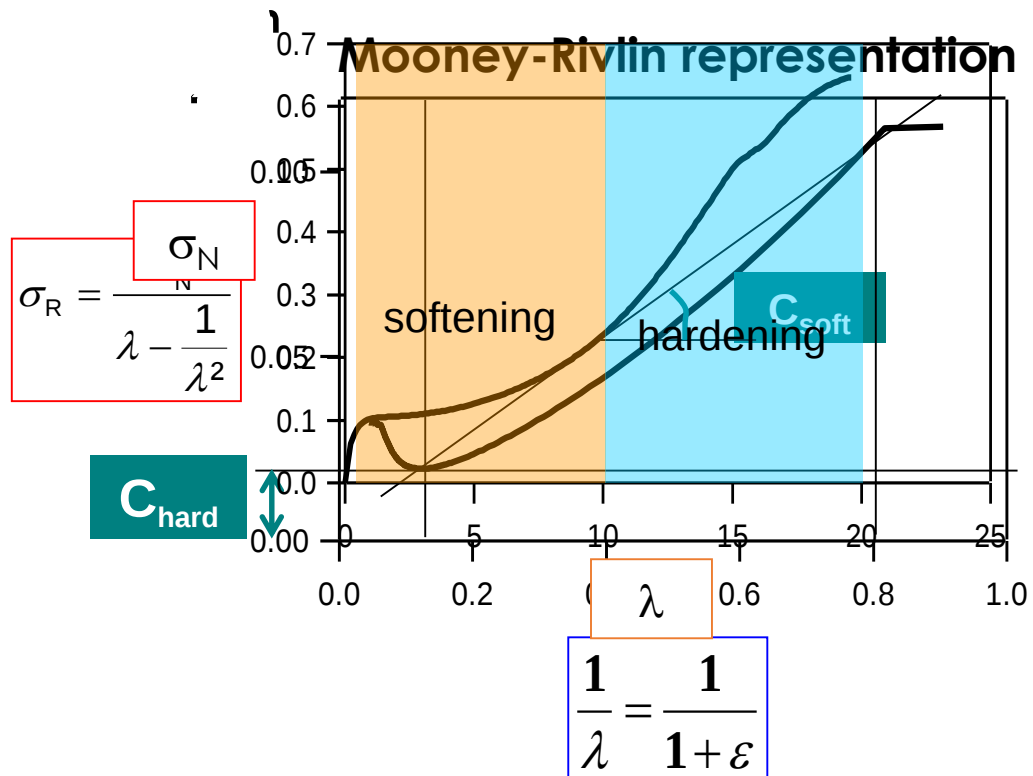


Light Scattering Techniques to Study
Dynamics: Microrheology

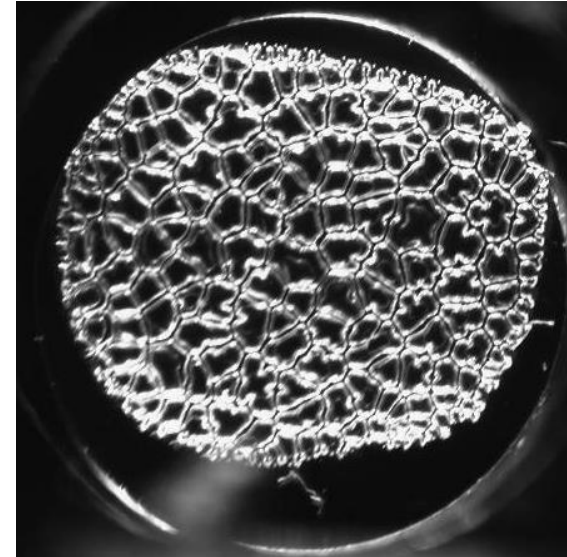


Why Double Dynamics ?

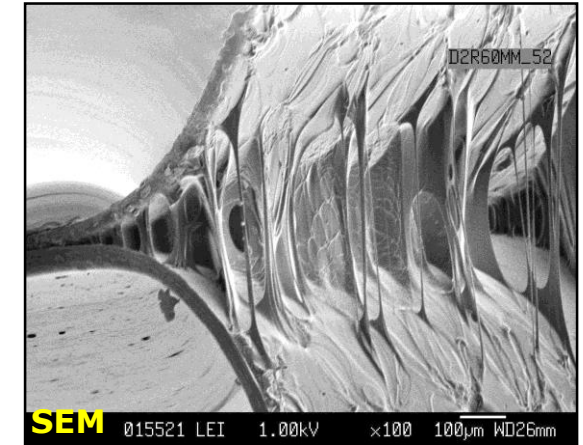
Control of Softening and Hardening



Crack blunting ->

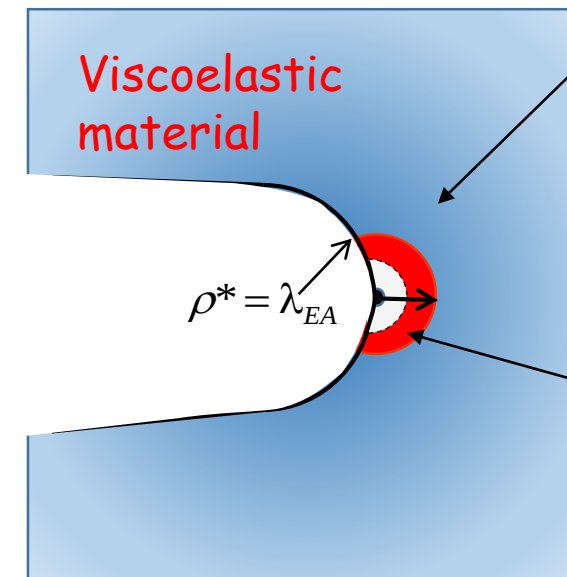


Strain hardening



Dissipation depends on crack Speed. Linear viscoelasticity holds

Persson, B. N. J.; *J. Phys.-Cond. Mat.* **2005**, *17*, (44), R1071-R1142., *Phys Rev E* **2005**, *71*, (3), 036123.

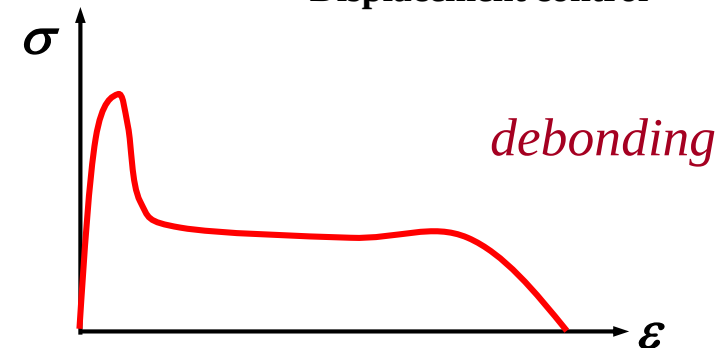
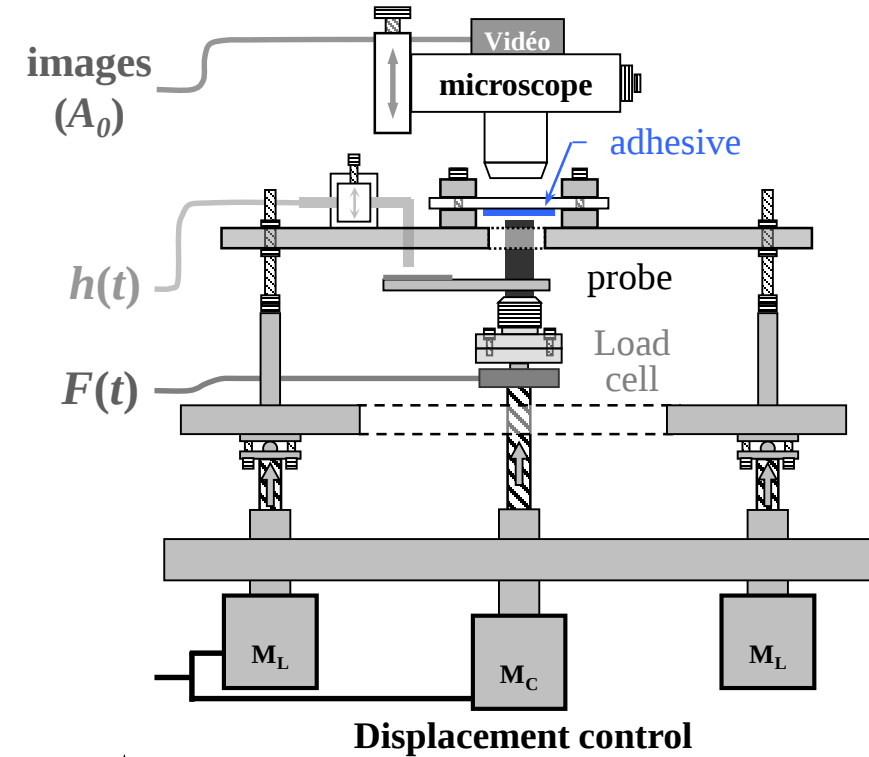
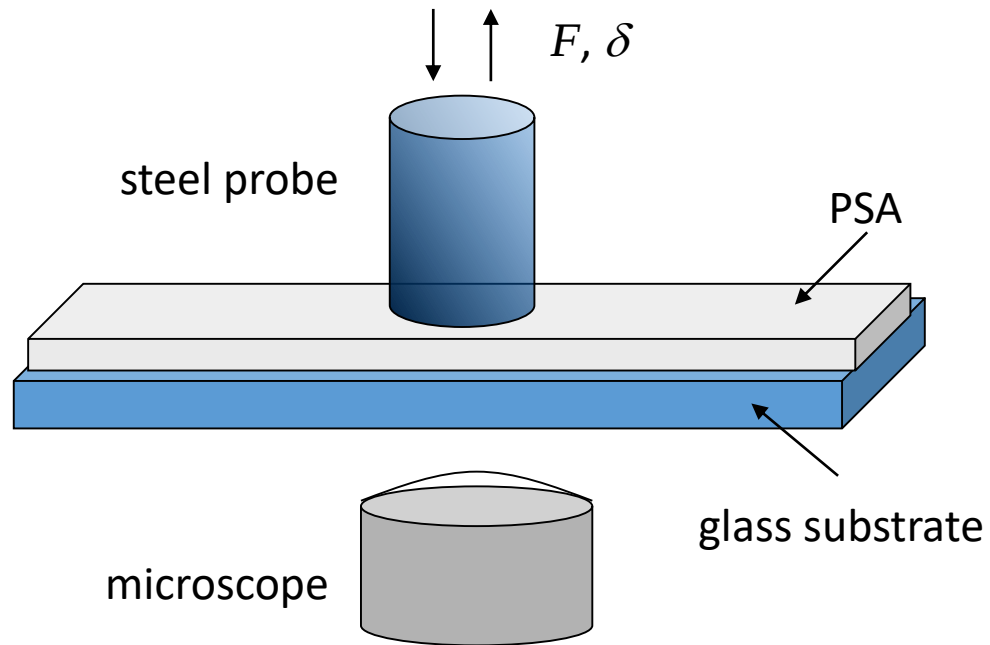


Dissipation is controlled by Large strain behavior.
Can be rate dependent

Development of custom-designed testing devices specifically adapted to soft and deformable materials.

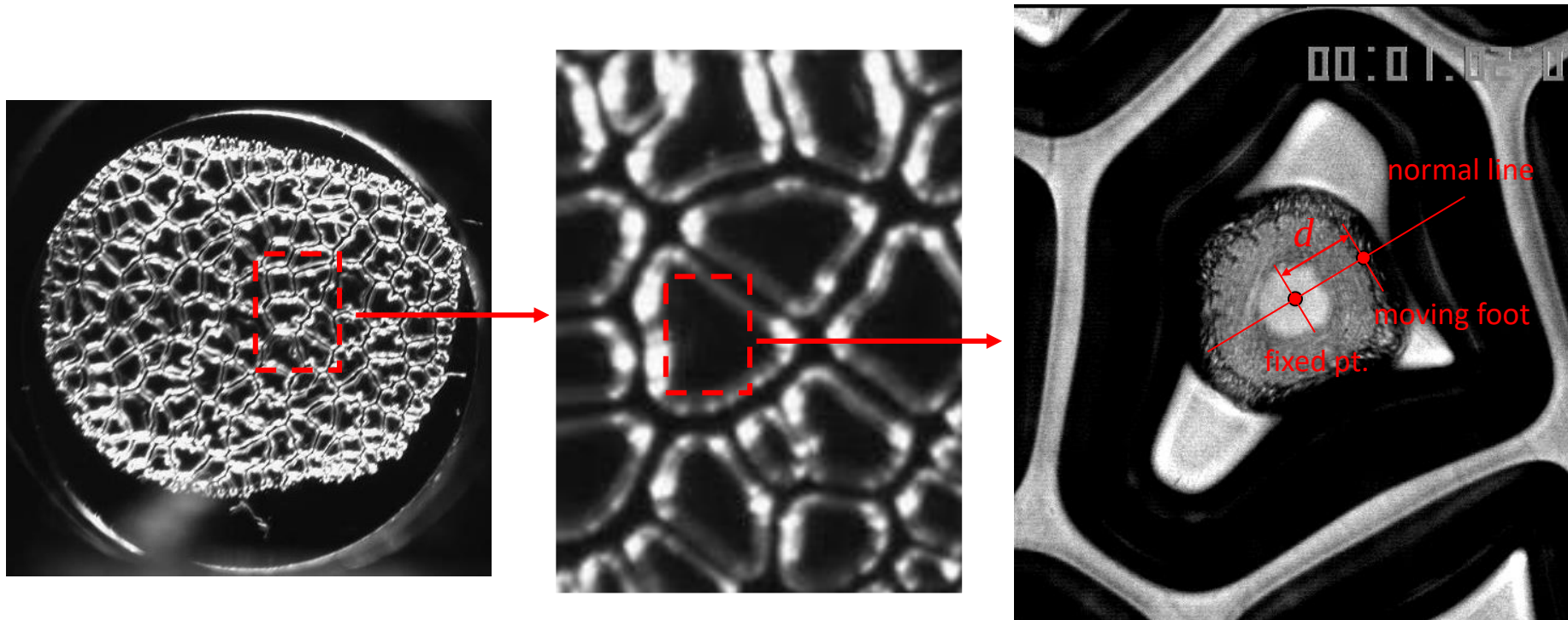
Combination of mechanical testing and real-time visualization

Adhesion problems



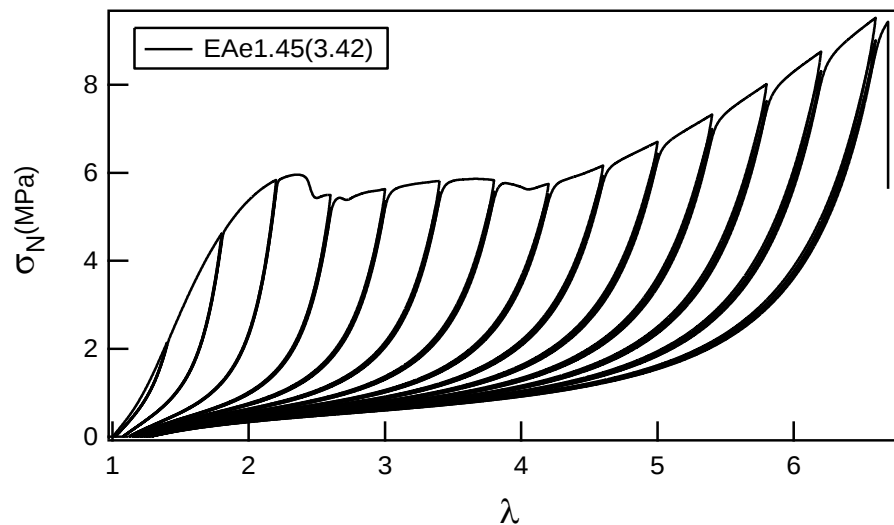
K. R. Shull, C. Creton, *J. Polym. Sci. B Polym. Phys.* **2004**, 42, 4023.

N. J. Glassmaker, C. Y. Hui, T. Yamaguchi, C. Creton, *Eur. Phys. J. E* **2008**, 25, 253.

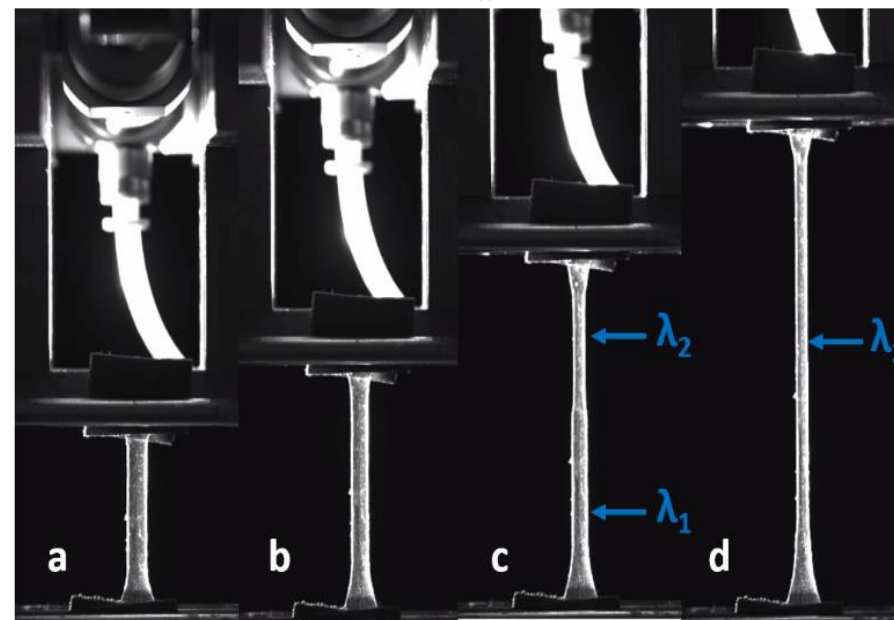
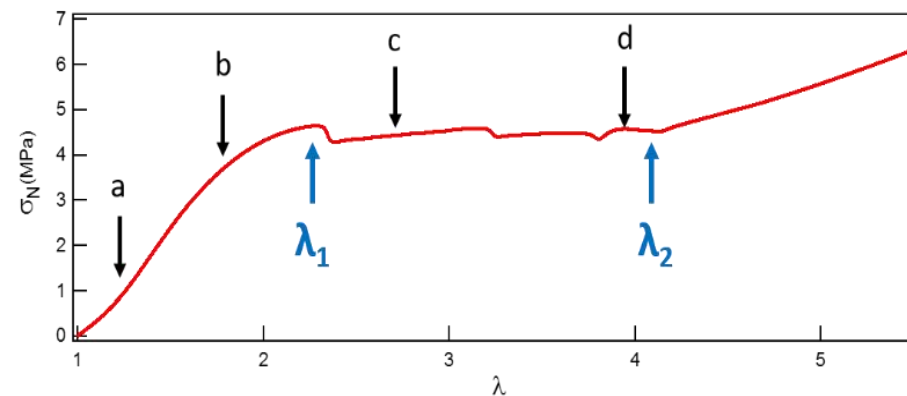
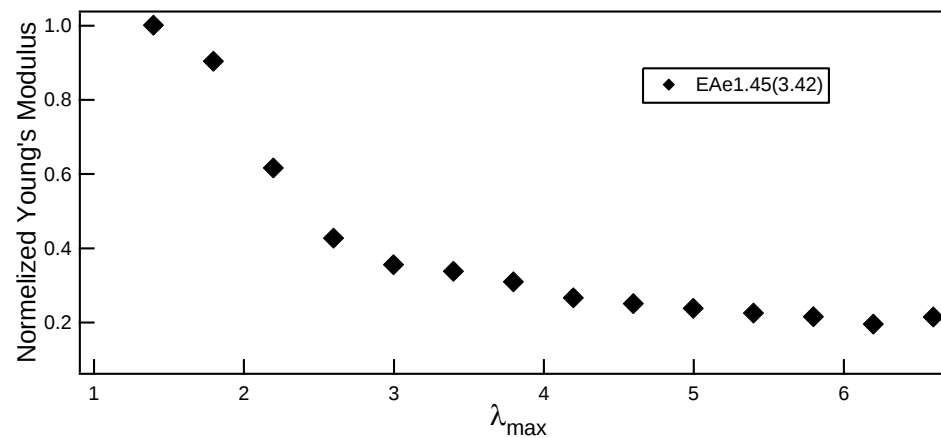


Micromechanics is a powerful tool to analyze the effect of changes in
Chemistry on mechanical properties

Mechanical properties and structure in large deformations

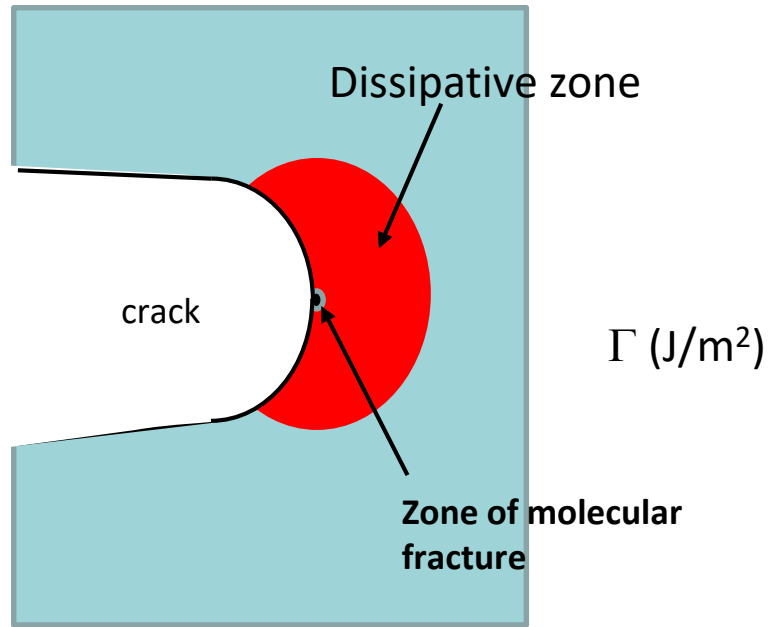


Hysteresis, damage, viscoelasticity and residual deformation

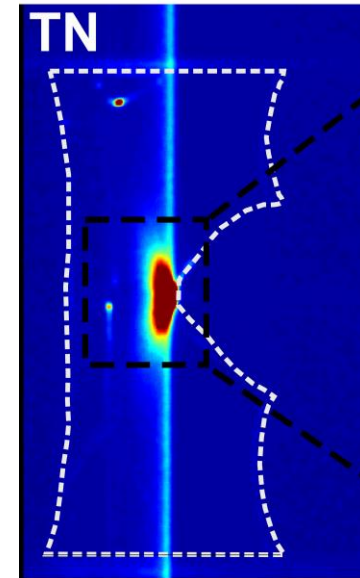
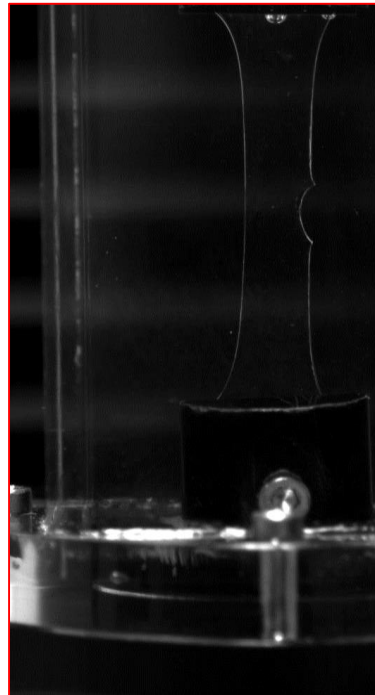
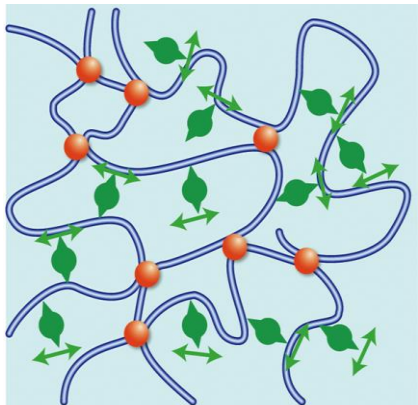


Yielding in multiple network elastomers

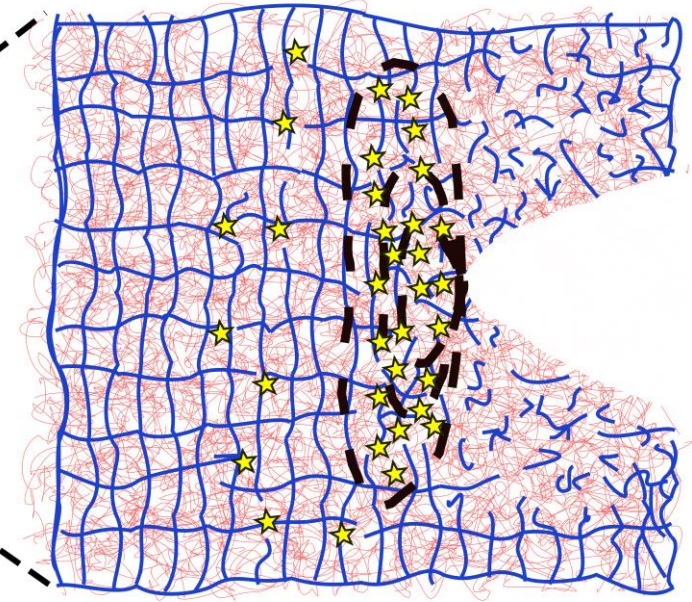
Fracture characterization



Dual crosslink networks



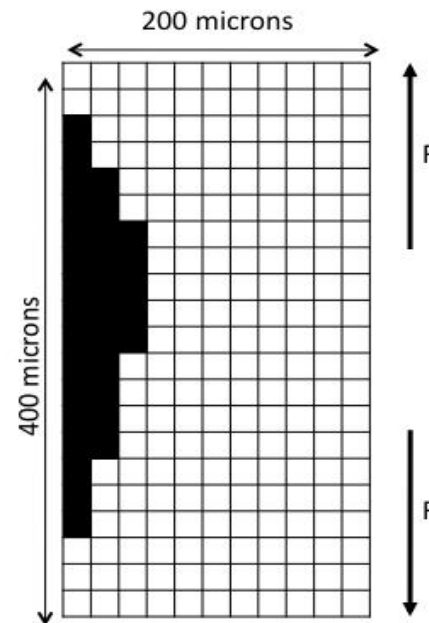
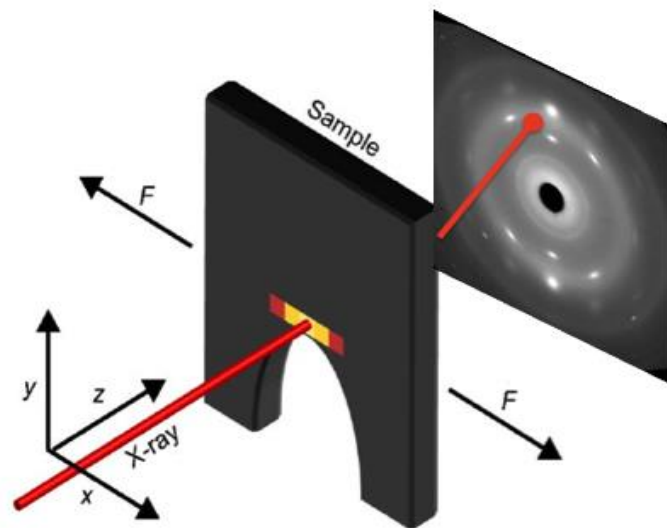
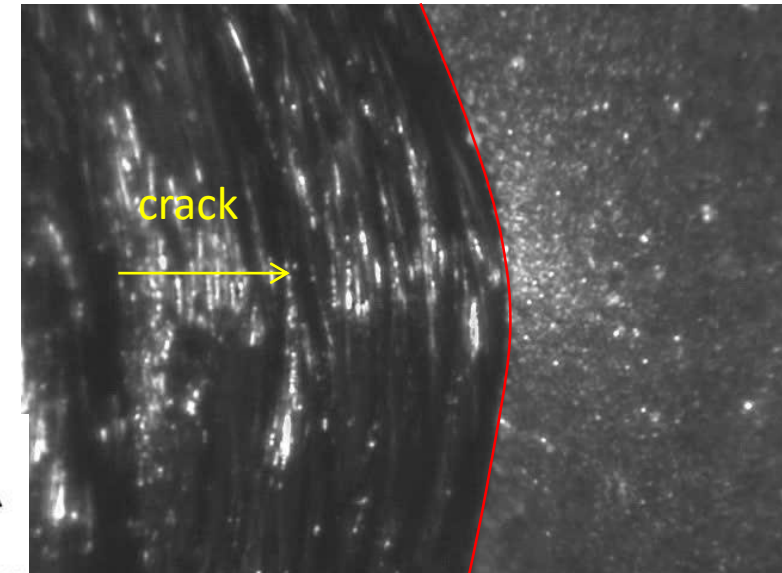
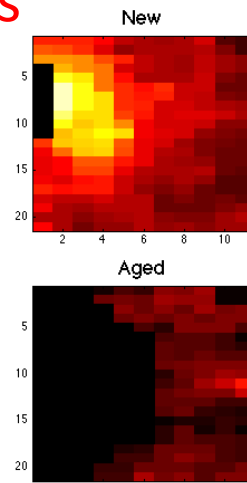
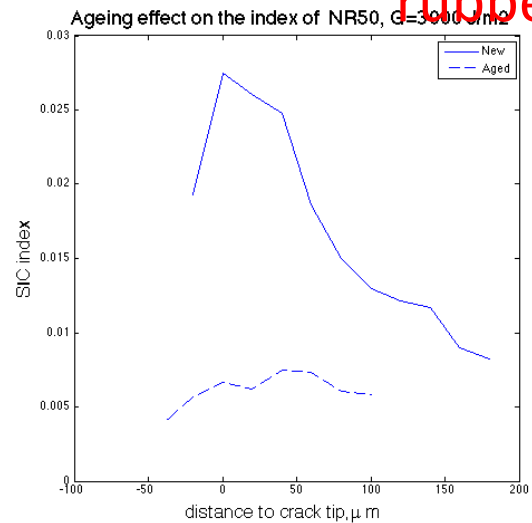
Mapping of bond scission
Mechanochemistry



Double Network Elastomers

Creton, C., 50th Anniversary Perspective: Networks and Gels: Soft but Dynamic and Tough. *Macromolecules* **2017**, *50* (21), 8297-8316.

Crack tip characterization in filled rubbers



Digital image correlation
and X-ray diffraction

Natural rubber