

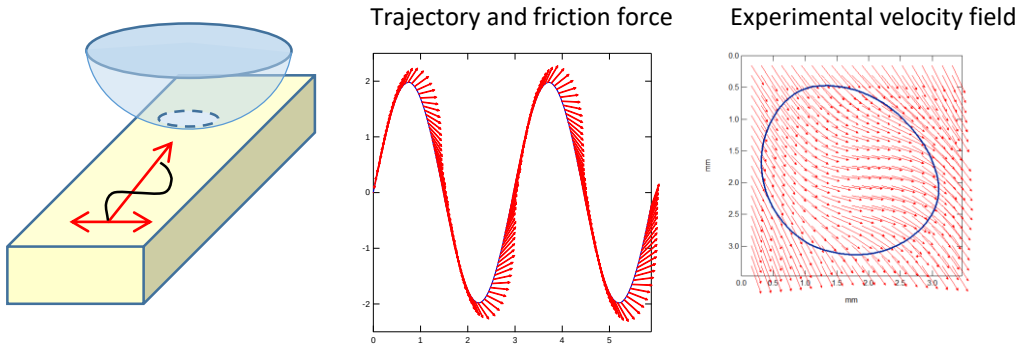
Out of equilibrium interfaces in soft solids contacts

A. Chateauminois, C. Frétnigny, Y. Tran, E. Verneuil

- Transient friction in finite size contacts: mechanical and geometrical non-uniformities**

Memory effects in rubber friction

Collab. Hutchinson, Montargis
F. Amiot, FEMTO, Besançon



Sinus wave motions: friction force not tangent to trajectory.
Model : non-uniform displacement field within contact area.

Fazio *et al.* *Proc. Roy. Soc. A* (2021)

- Adhesion of model rough surfaces**

Collab. G. Violano, L. Afferante &
M. Ciavarella, Polytechnico di Bari

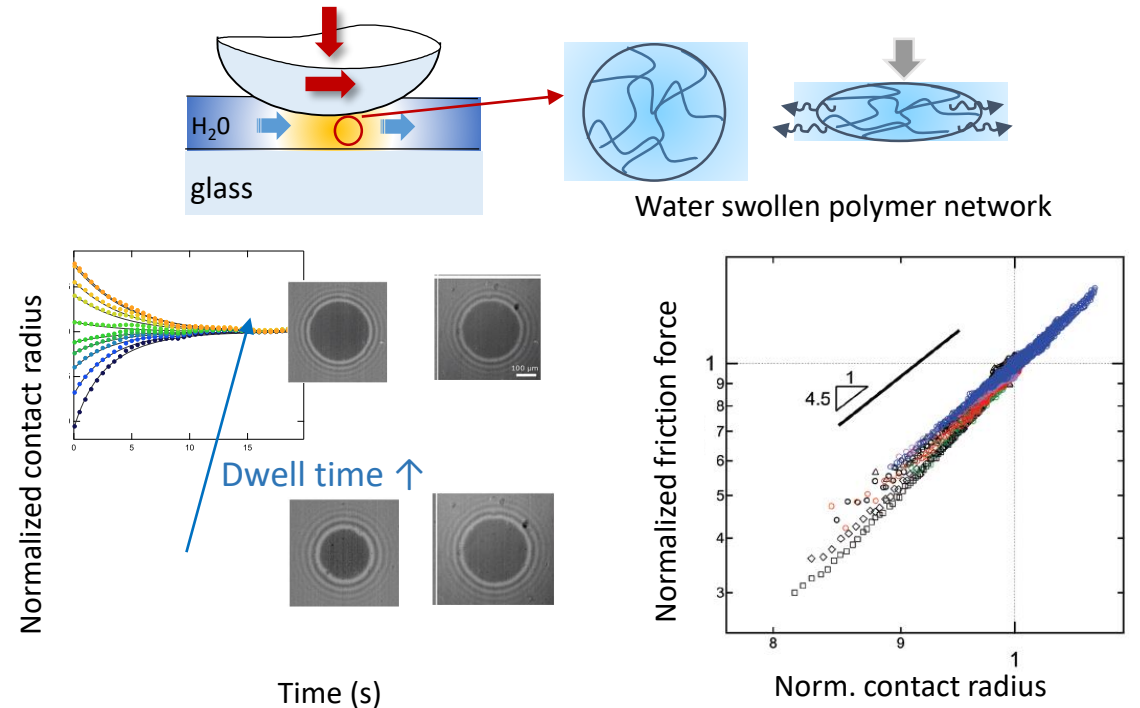
Rubber surfaces with spherical microasperities:
viscoelastic dissipation during pull off

Acito *et al.* *Trib. Lett.* (2019)

Violano *et al.* *Mech. Mat.* (2021); *Frontiers in Mech. Eng.* (2021)

Onset of sliding on thin hydrogel films: friction and poroelastic transport

Collab. SGR Paris, Aubervilliers
C.-Y. Hui, Cornell U., USA



Poroelastic flows set contact size dynamics: modelled within a thin film approximation

Time variations of contact area set those of the friction force through a power law

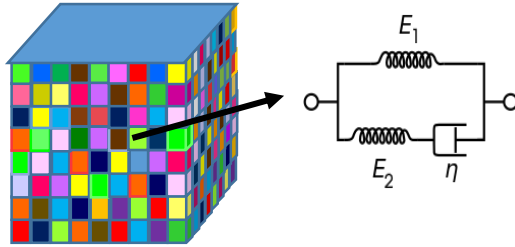
Ciapa *et al.* *Soft Matter* (2020)

Delavoipière *et al.* *Langmuir* (2018)

Upscaling from microscopic physics to macroscopic mechanics of solid polymers

H. Montes, L. Talini, C. Frétiigny, F. Lequeux

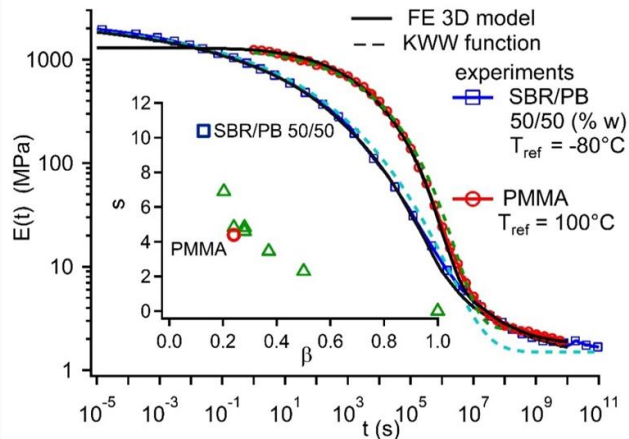
Modeling the mechanics of amorphous polymer:



Collaborations: Hutchinson
S. Cantournet Ecole des Mines

- Accounting for local dynamical heterogeneities

- Linking local and macroscopic weak non-linearities



Belguise et al. in *Mechanics and Physics of Solids at Micro- and Nano-Scales* (2019) Wiley

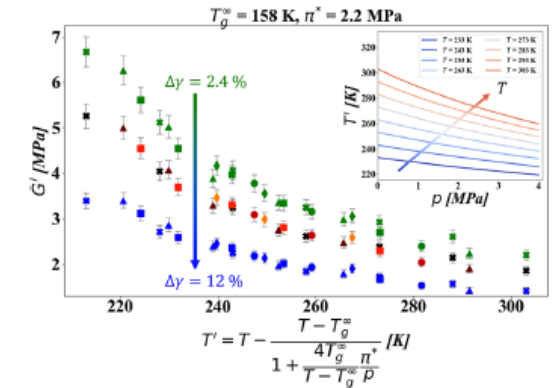
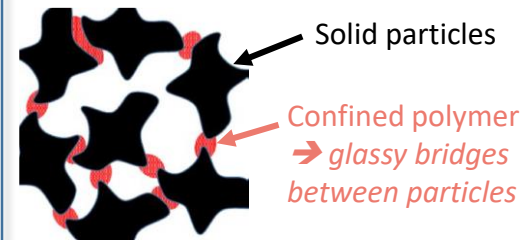
Local non linearity $\eta = E\tau e^{-\sigma^2/Y^2}$ $\rightarrow$ Macroscopic non linearity $e^{-\sigma/Y}$

Belguise et al. *Phys. Rev. Mat* (2021)

Mechanics of filled elastomers

Collaborations: Hutchinson
S. Cantournet Ecole des Mines

- Networks of solid particles connected by glassy bridges control the mechanics of filled elastomers
- $\rightarrow$ New pressure/temperature superposition law

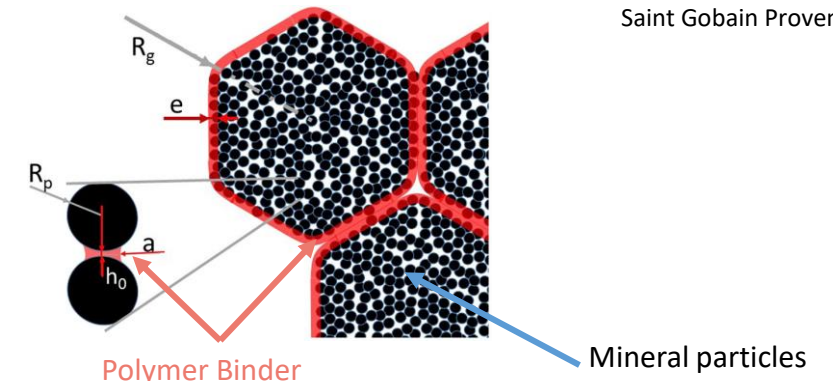


Champagne et al. *Macromol* (2021),
Colombo et al. *Mech. Mat.* (2020)

Role of polymer binders in the shaping process of ceramics

Boursier et al. *Ceramics Int.* (2020)

Collaboration:
Saint Gobain Provence

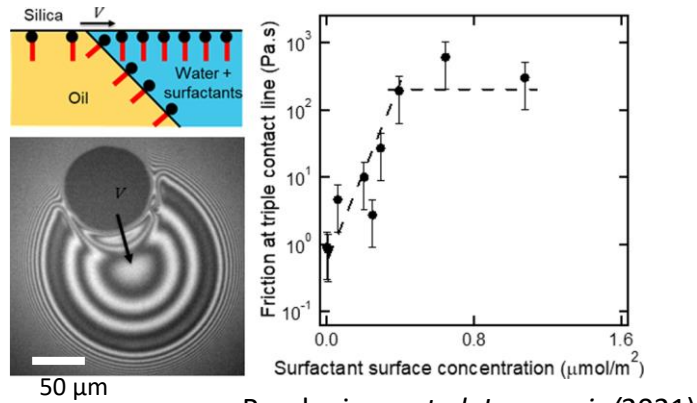


Coupling between molecular scale transfers and macroscopic flows along and towards fluid interfaces

F. Lequeux, E. Verneuil, A. Chateauminois, J. Comtet

Contact line friction at surfactant-laden solid interfaces controlled by the lability of the molecular layers

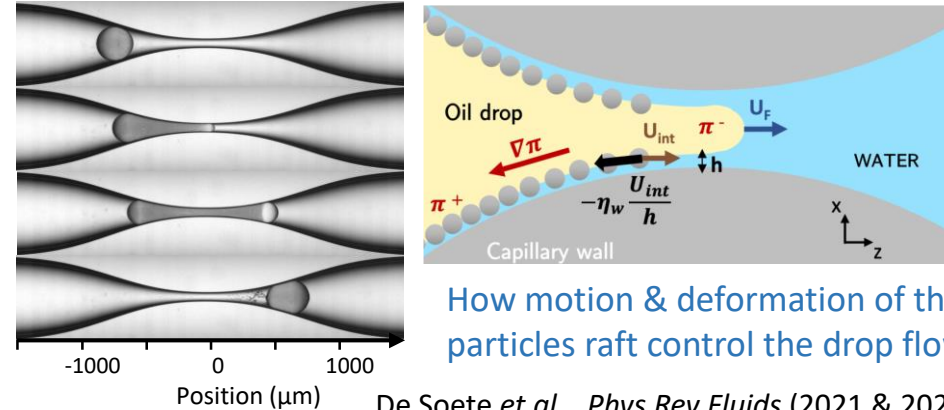
Collab.: TotalEnergies
Laurent Limat (MSC U. Paris Cité)



Marangoni-like effects at flowing interfaces

Collaborations: TotalEnergies
Laurence Talini (SVI, Saint Gobain/CNRS)

- Particle-laden drops flowing through a pore

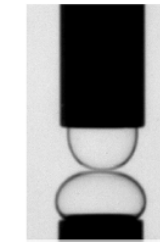


- Understanding the stability of foamed liquid mixtures

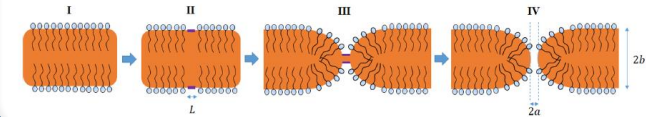
Tran et al., *Phys. Rev. Lett.* (2020),
Langmuir (2021)

How coalescence mechanisms are controlled by surfactants mixtures in dense emulsions: Renewing hole nucleation theory

Collaborations: TotalEnergies
Pascal Panizza (IPR, U. Rennes)
Véronique Schmidt (CRPP, U. Bordeaux)

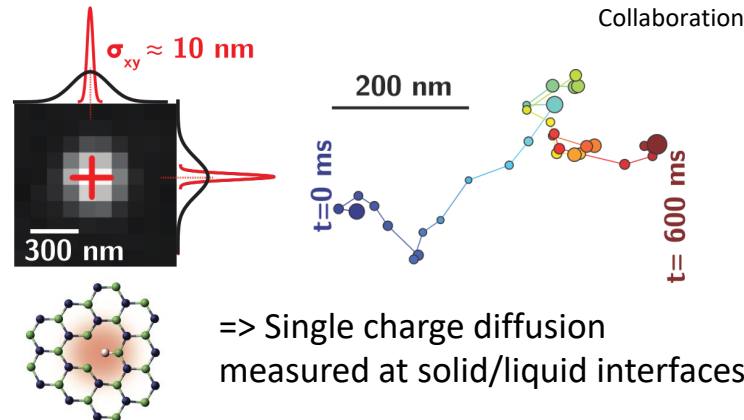
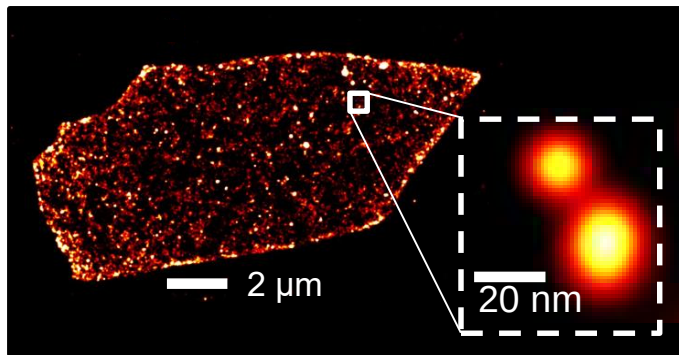


Dinh et al., *Langmuir* (2021)
Dinh et al., *Soft Matter* (2020)



Super-Resolution Microscopy to probe molecular scale dynamics at interfaces

Single defects in hexagonal Boron Nitride

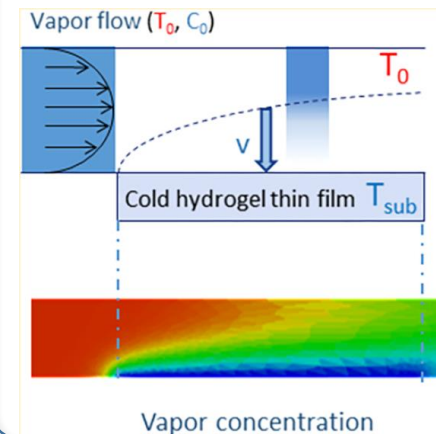


Collaboration: Aleksandra Radenovic, EPFLausanne

Comtet et al. *Nano Letters* (2019), *Nature Nanotechnology* (2020), *Science Advances* (2021)

How physico-chemistry sets hydrogel films swelling kinetics and dew nucleation

Collaborations:
Saint Gobain
Marc Fermigier (PMMH ESPCI Paris)



Delavoipière et al., *Langmuir* (2018)

Probing the dynamics of ultrathin films reveals the molecular interactions

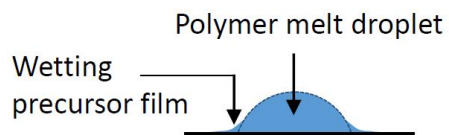
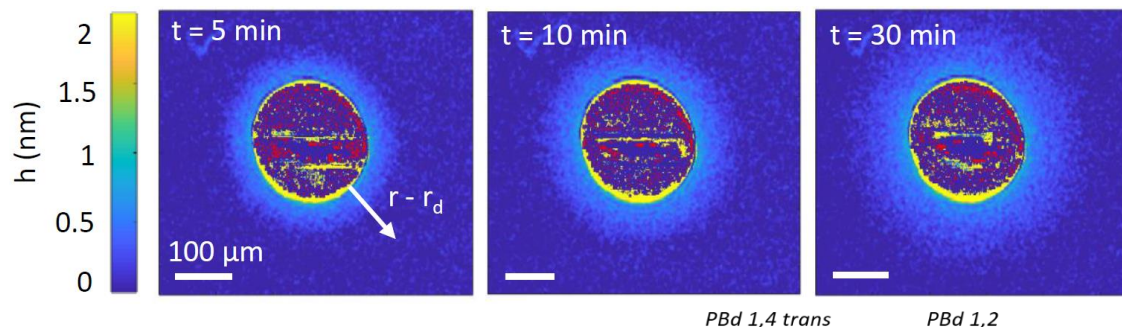
F. Lequeux, H. Montes, C. Frétiigny, L. Talini, A. Chateauminois, E. Verneuil

Spreading dynamics of polymer chains as a tool to measure monomer substrate interactions

Collaborations: Solvay Silica
Jürgen Thiel, Max Planck Institute for Polymers, Mainz

How : wetting precursor films of polymer melts in pseudo-partial conditions
=> low density films of independent chains diffusing as Rouse

Results : measurement of monomer/silica adsorption energy versus chemistry



Polymer	E_a [kJ/mol]
PBd 1,4	30 ± 5
PBd 1,2	48 ± 5

Schune et al. *ACS Macro Lett* (2020), *Langmuir* (2019)

How Van der Waals interactions sets the thermal fluctuations at the free surface of nanometer-thick films

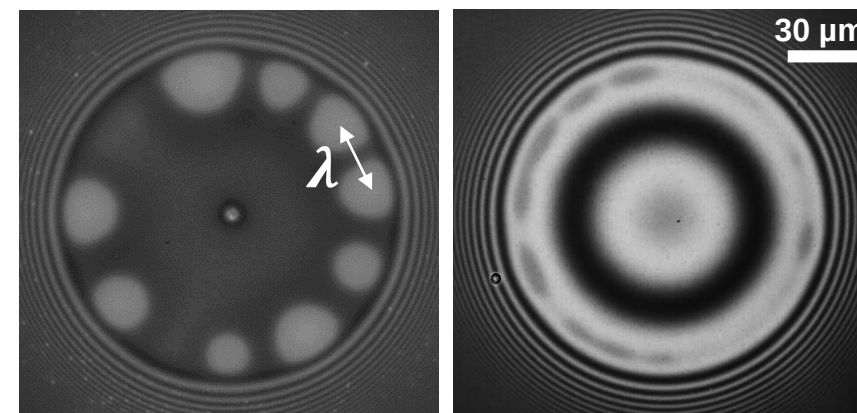
Collaboration: Thomas Bickel LOMA, Bordeaux
Support: UPTO-PARIS international doctoral COFUND programme

Clavaud et al. *Phys Rev Lett* (2021)

Step-wise thinning and metastable thin layers reveals spinodal stratification of micellar films between oil and silica for nTAB cationic surfactants

Collaboration: TotalEnergies

Rondepierre et al. *Phys Rev E* (2021)



From physics to technology

Tof SIMS analysis of molecular parameters in ultrathin acrylate polymer films for microelectronics

Collaboration: CEA Grenoble

Ben Hadj Mabrouk et al. *Surface and Interface Analysis* (2021)

Measurement of thermal properties of bulk materials and thin films by modulated thermorefectance (MTR).

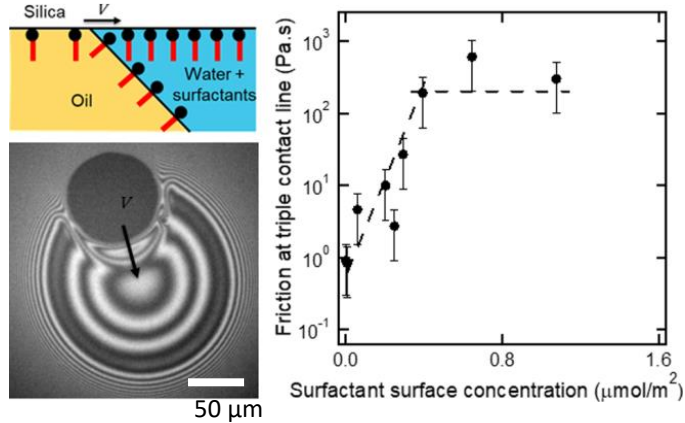
Collaboration: Danièle Fournier INSP, Sorbonne U.

Fournier et al. *Journal of Applied Physics* (2020)

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F. Lequeux, E. Verneuil, A. Chateauminis

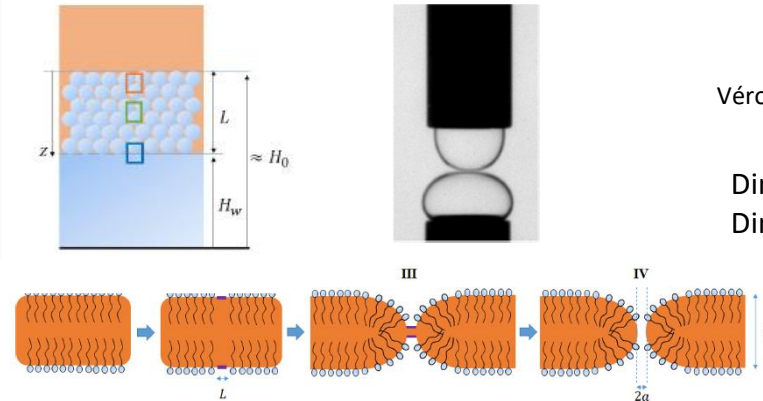
Evidence for contact line friction at surfactant-laden solid interfaces controlled by the lability of the molecular layers



Collaborations: TotalEnergies
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Rondepierre *et al.*, *Langmuir* (2021)

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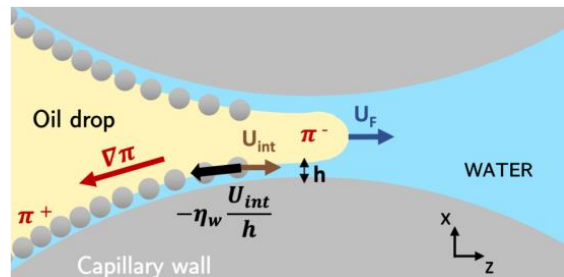
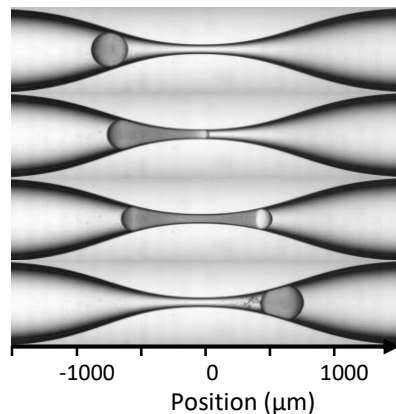


Collaborations:
TotalEnergies
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Véronique Schmidt (CRPP, U. Bordeaux)

Dinh *et al.*, *Langmuir* (2021)
Dinh *et al.*, *Soft Matter* (2020)

Marangoni-like effects at flowing interfaces

- Particle-laden drops flowing through a pore : how motion and deformation of the raft of adsorbed particles control the flow



De Soete *et al.*, *Phys Rev Fluids* (2021), (2022)

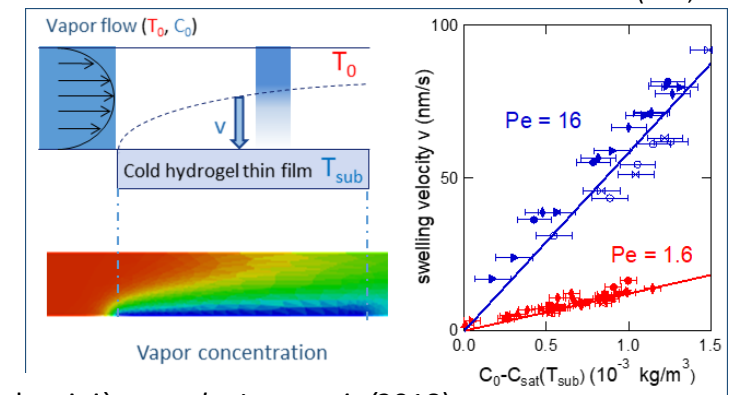
Collaborations: TotalEnergies
Laurence Talini (Labo SVI, Saint Gobain/CNRS)

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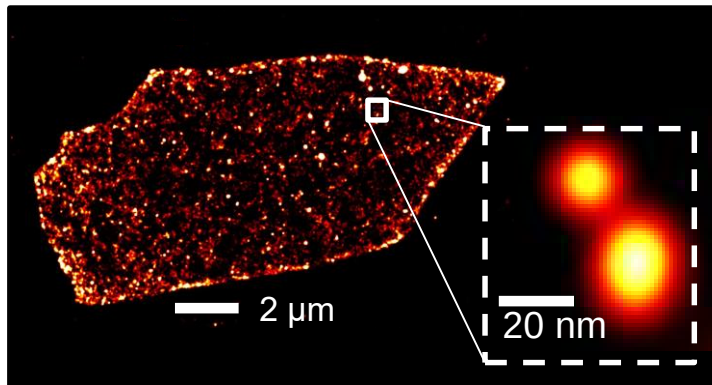
Collaborations: Saint Gobain
Marc Fermigier (PMMH, ESPCI Paris)
Yvette Tran (SPN, SIMM)



Delavoipière *et al.*, *Langmuir* (2018)

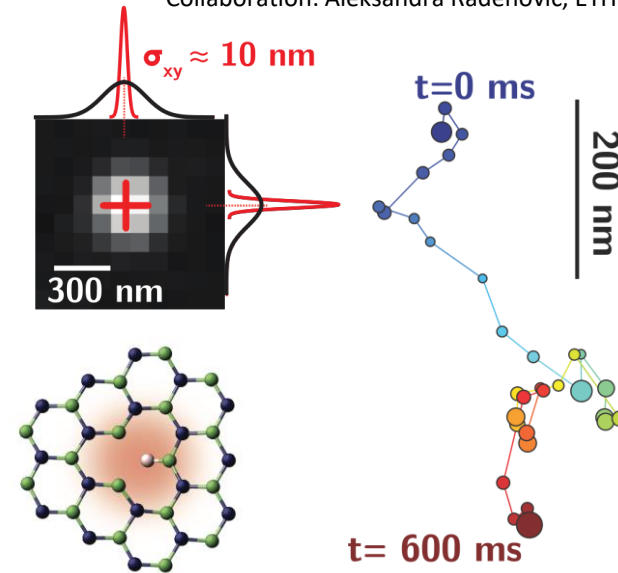
Super-Resolution Microscopy

Single defects in hexagonal Boron Nitride



J. Comtet *et al.* *Nano Letters* (2019), *Nature Nanotechnology* (2020), *Science Advances* (2021)

Collaboration: Aleksandra Radenovic, ETH Zurich



=> Single charge diffusion at solid/liquid interfaces