KTH Chemical Science and Engineering

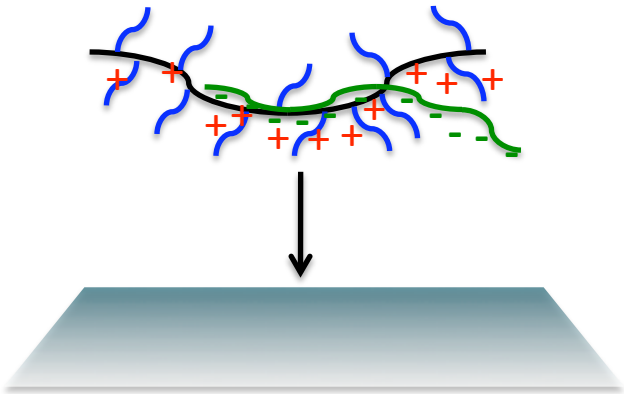
Per Claesson

Small-Angle Scattering for Soft Matter

some current and future interests of Surface and Corrosion Science at KTH

General interest:

Self-assembly systems in bulk and at interfaces



Structure?
Dynamics?
Interactions?
Shear effects?
Pressure effects?

Magnus Bergström

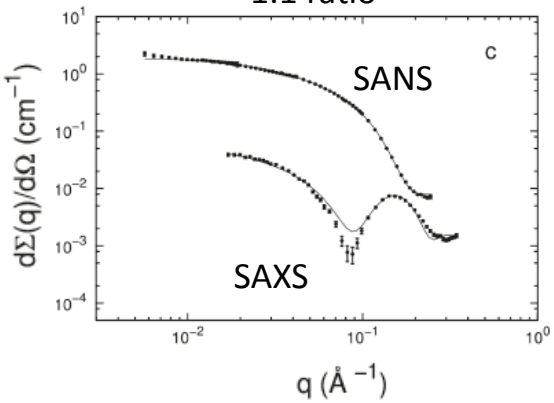
Andra Dedinaite

Per Claesson

Daniel Kalnin

Some recent activities – surfactant mixtures

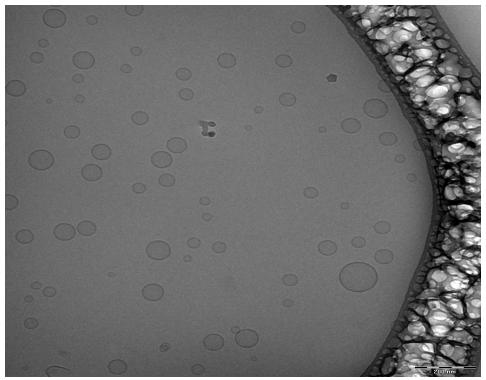
1:1 ratio



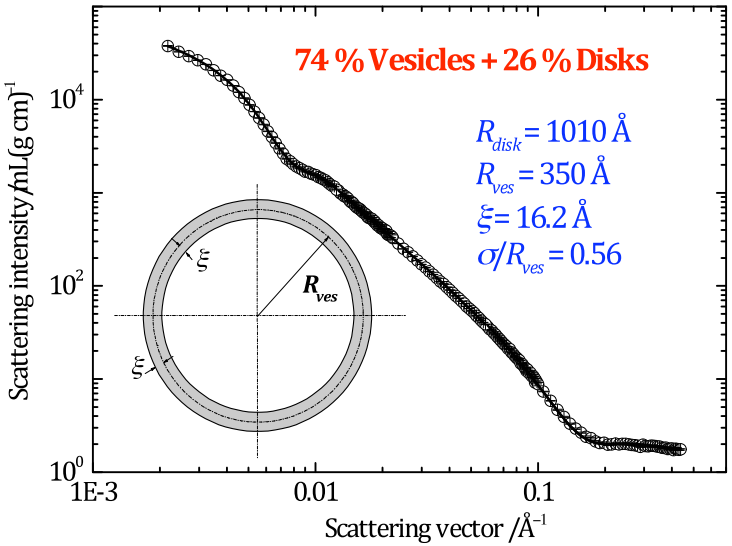
Mixtures of two non-ionic surfactants $C_{12}E_6$ and $C_{12}G_2$
Coexistence of spheres and spherocylinders
SAXS and SANS data fitted with the same model
Langmuir 25, 7296 (2009)

SOS	***cmc* = 133 mM**
CTAB	***cmc* = 0.9 mM**

Mixtures of an anionic and a cationic surfactant

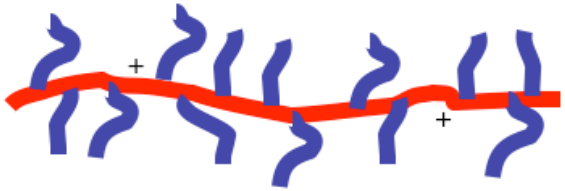


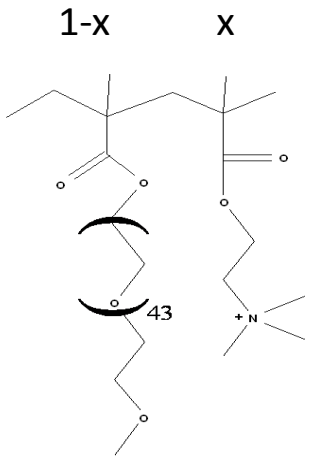
CRYO TEM



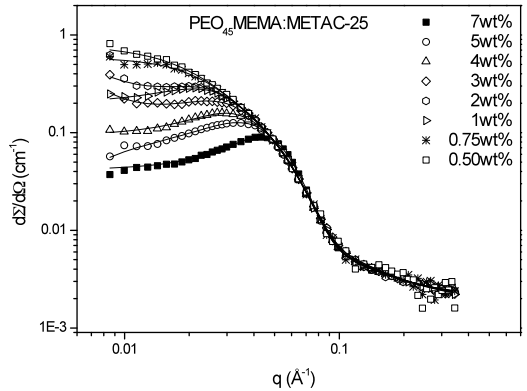
90% SOS
20 mM

Some recent activities – bottle-brush polymers

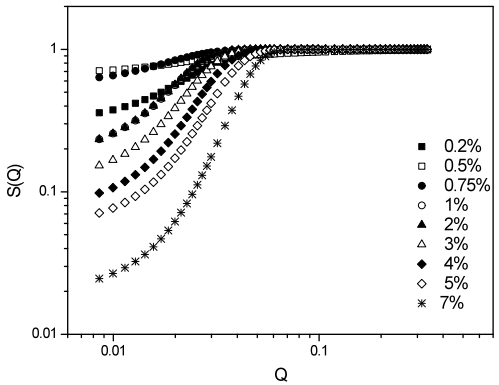




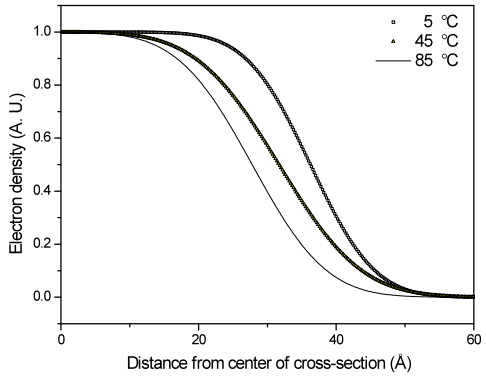
Data and fit using graded cylinder model



Structure factor



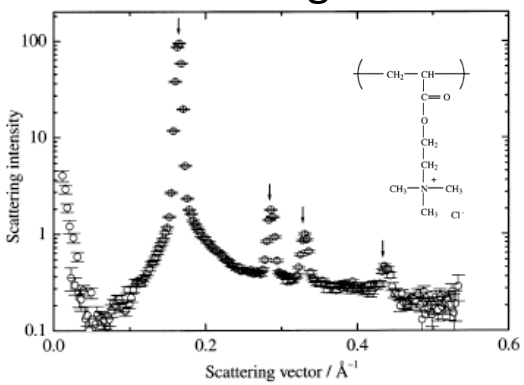
Cross-section



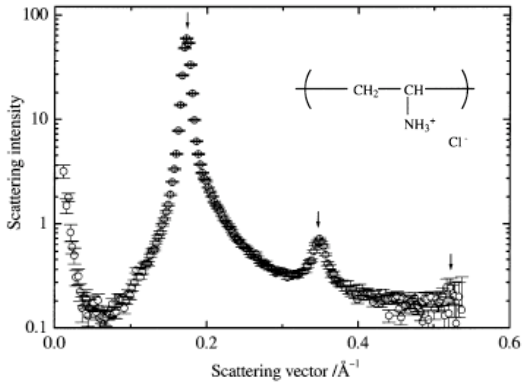
Structure and interactions of bottle-brush polymers, to be published

Some recent activities, polyelectrolyte-surfactant mixtures

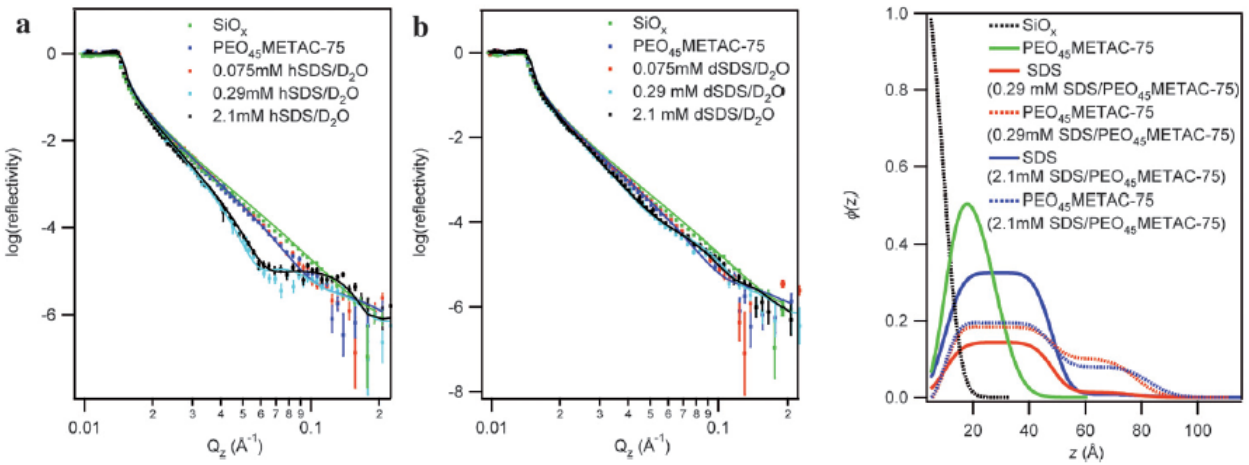
Hexagonal



Lamellar



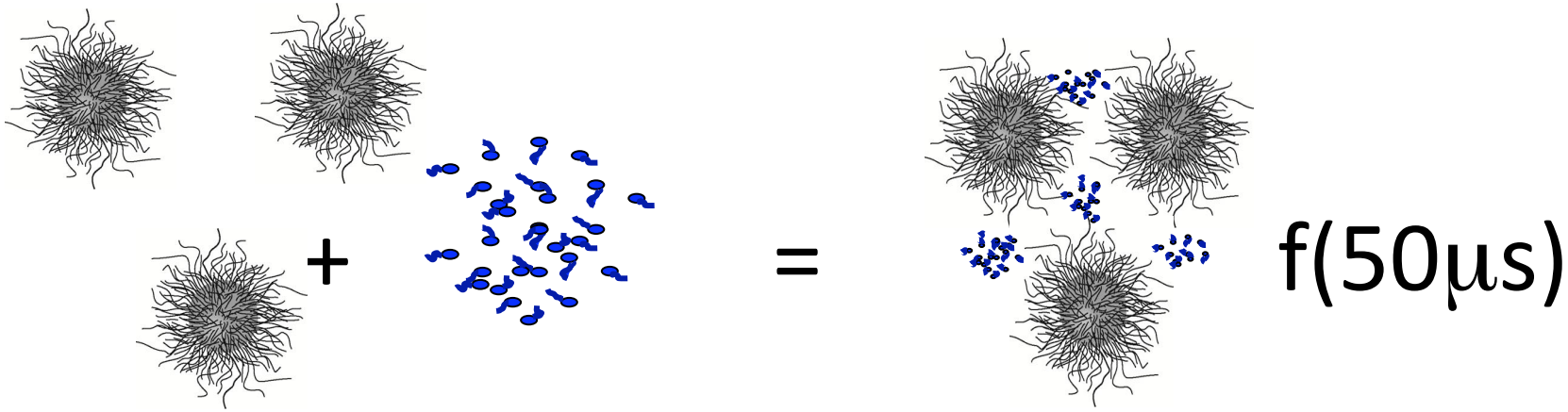
Internal structure of complexes between cationic polyelectrolytes and SDS
SAXS data
J. Phys. Chem. B 106, 11412, 2002



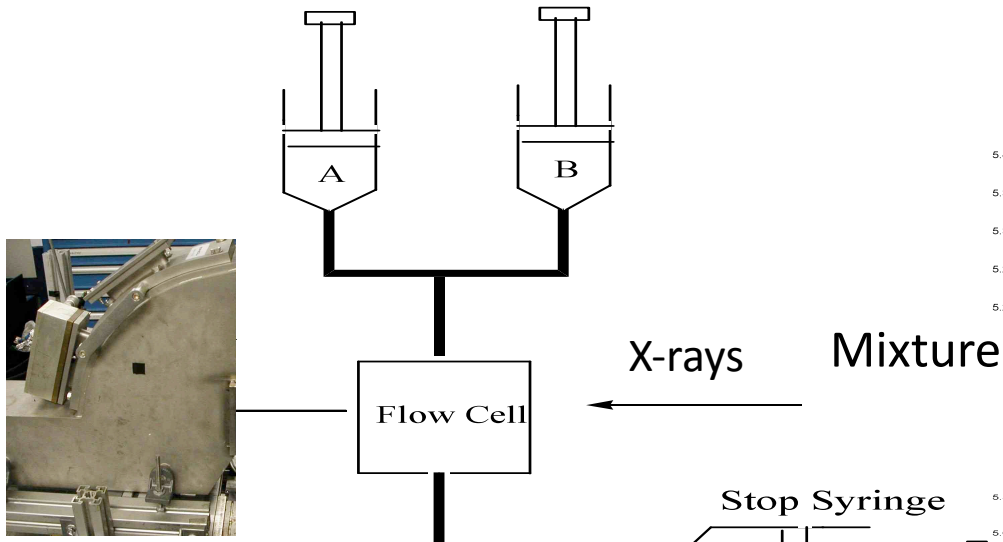
Specular neutron reflectivity of bottle-brush polymer layers exposed to surfactants
Soft Matter 5, 3646, 2009
Small micellar-like aggregates are formed in the layer below cmc

Correlation between PDMMA grafted Silica nanoparticles

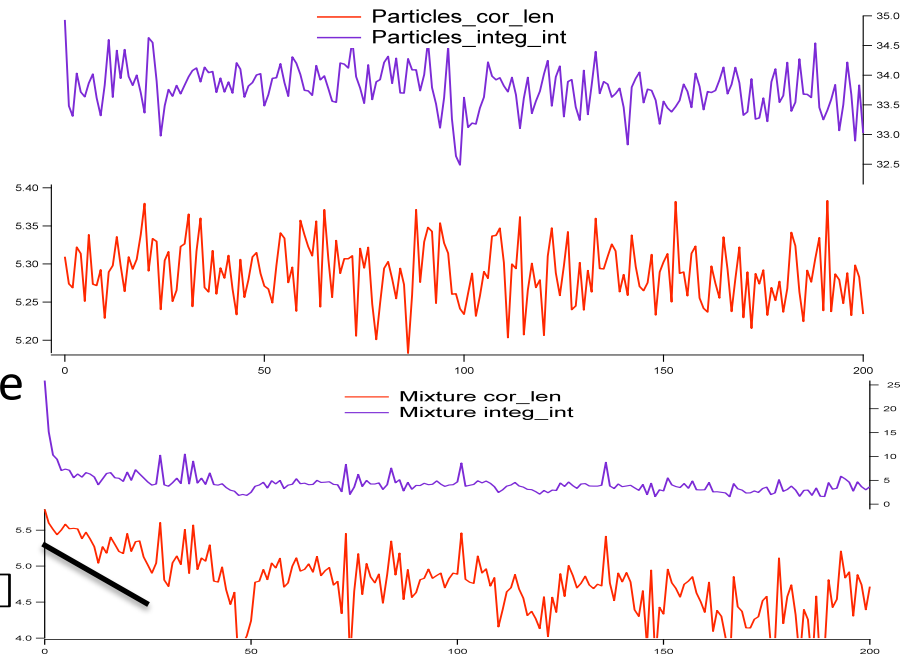
Addition of SDS -> decreasing correlation length within μs



ReferenceParticles



Mixture

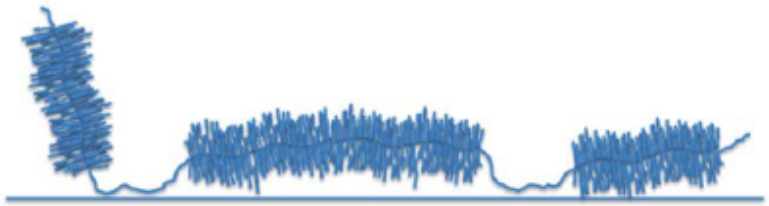


Recent data from Elettra

Future interests

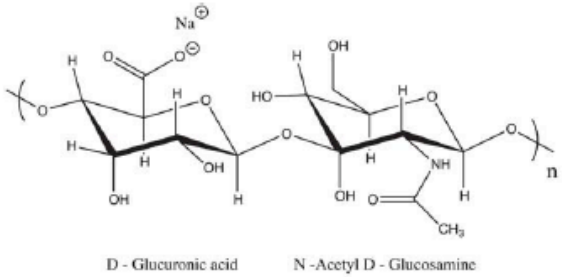
KTH Chemical Science and Engineering

- Responsive polymer layers
  - pH, temperature
  - Triggered self-assembly
- Self-assembly structures
  - **Kinetics** of assembly and disassembly
    - Stopped flow techniques
  - **Shear**-induced structural changes in bulk and at interfaces
    - Biolubrication aspects
  - **Pressure**-induced structural changes
    - Biolubrication aspects

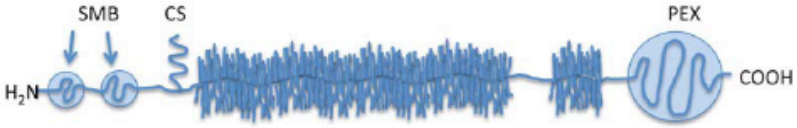


Some biopolymers of importance for joint lubrication

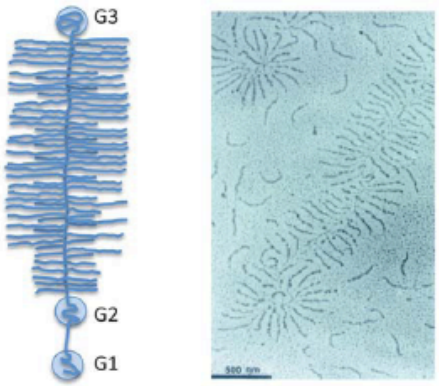
Hyaluronan

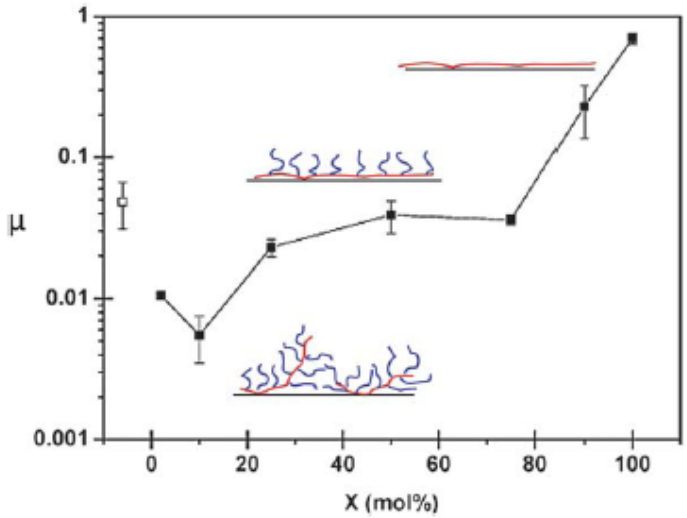


Lubricin



Aggrecan





They self-assembly with each other and with phospholipids:

- Scattering can contribute with understanding of structures, structural changes due to compression and shear
- Combined with nanotribological studies, a molecular understanding of biolubrication is within reach

KTH Chemical Science and Engineering

Our interests in Soft Matter scattering

- Self-assembly structures in bulk and at interfaces
- **Kinetics/Dynamics** of self-assembly
- **Shear** effects
- **Pressure** effects (up to ≈ 20 MPa in synovial joints)

Scientific collaboration in these areas would be highly interesting

Thank you for your attention!