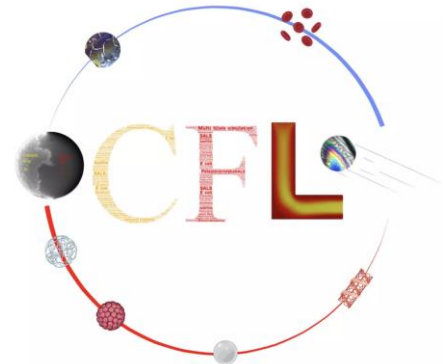


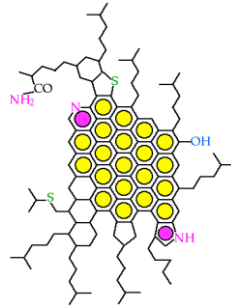
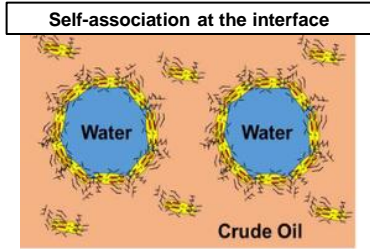
Interfacial Micro and Macro Rheology of Fractionated Asphaltenes

R. Khalesi, H. Yarranton, and G. Natale*

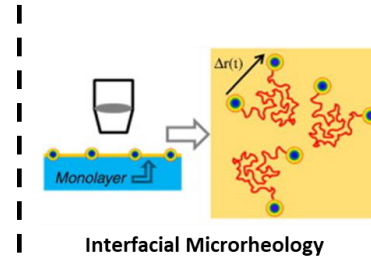
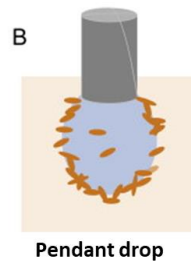
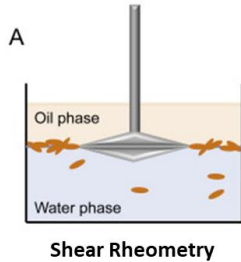
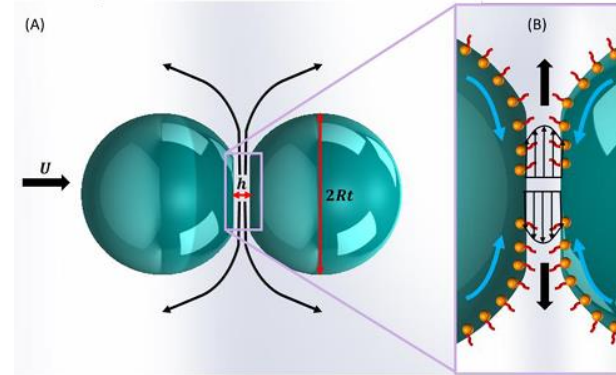
* Associate Professor, Lead of Complex Fluids Laboratory,
Chemical and Petroleum Engineering,
University of Calgary.



Why Interfacial Rheology?

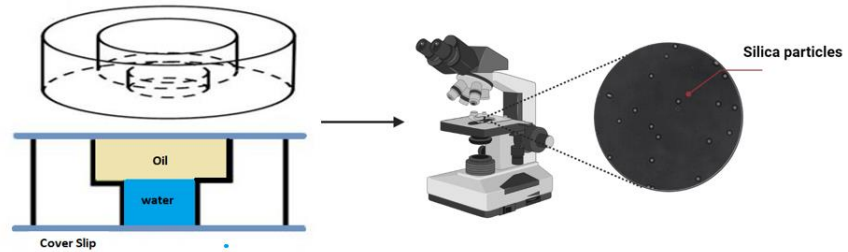
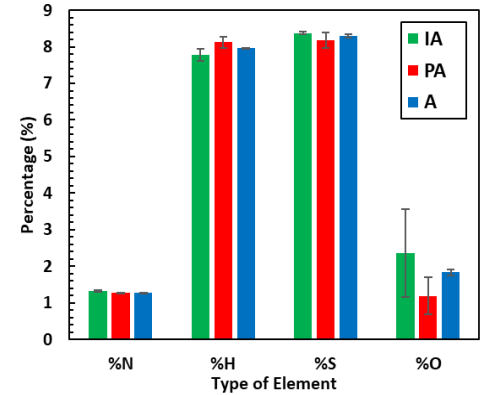
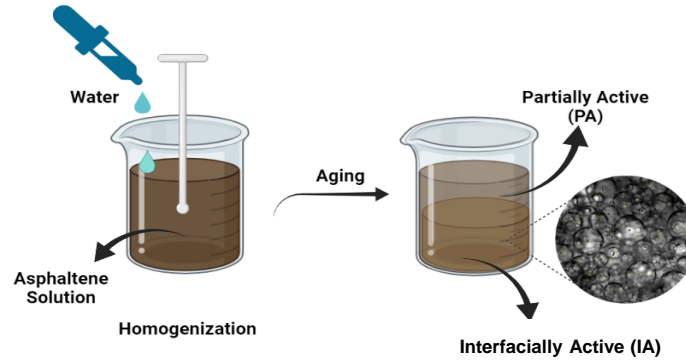
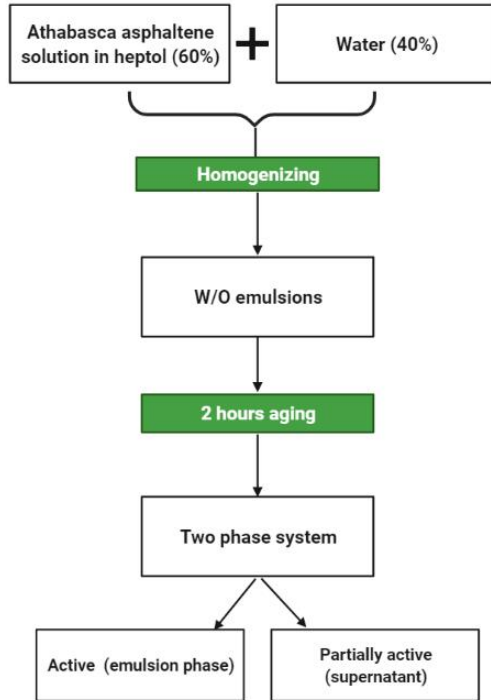


Various molecular structure \rightarrow differences in solubility and surface activity



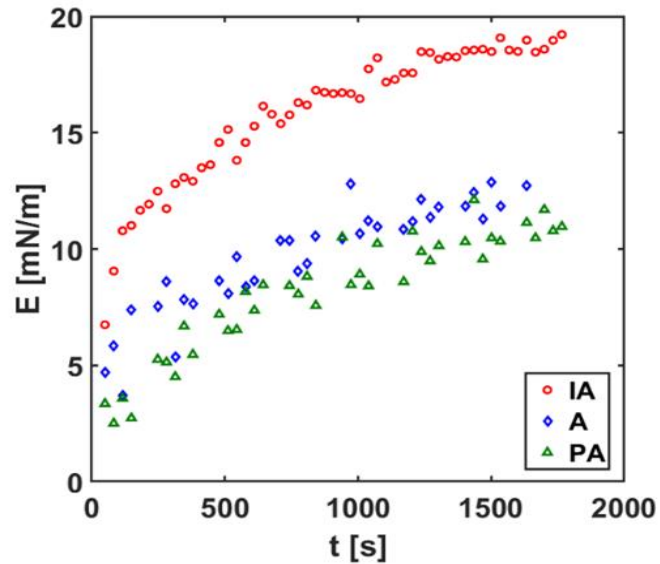
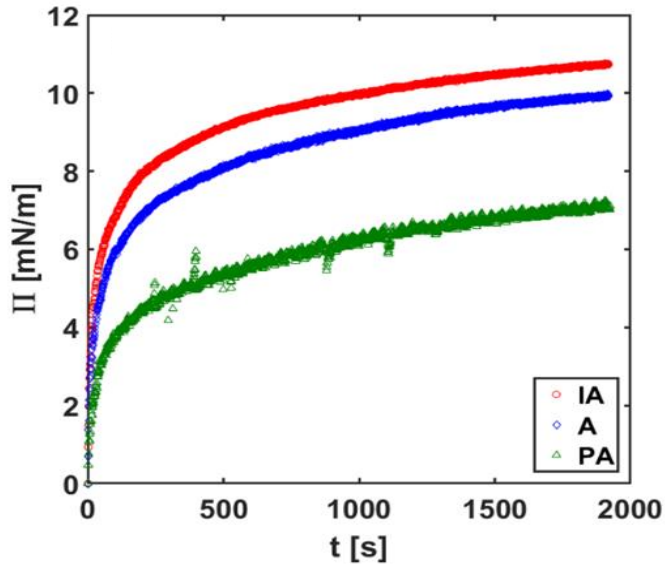
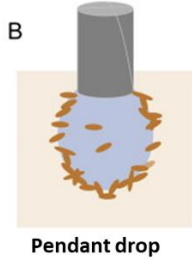
Macroscopic

Methodology

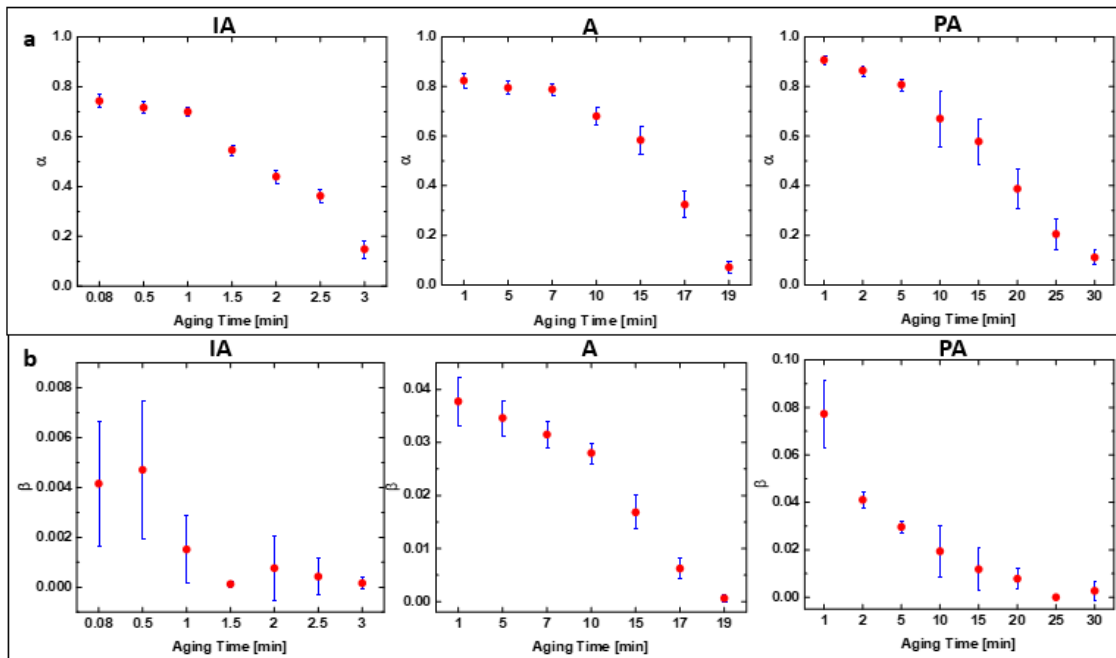
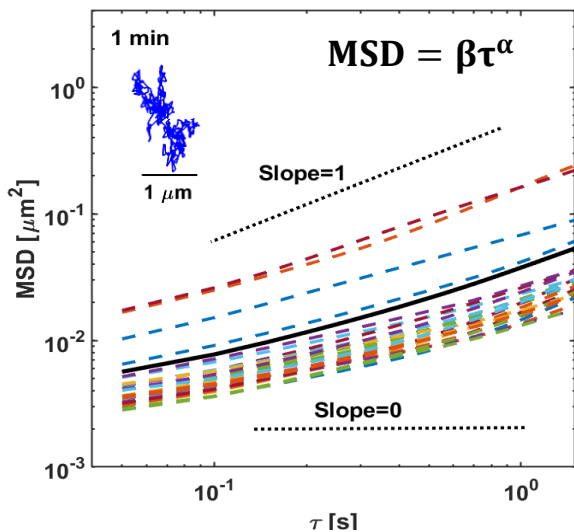
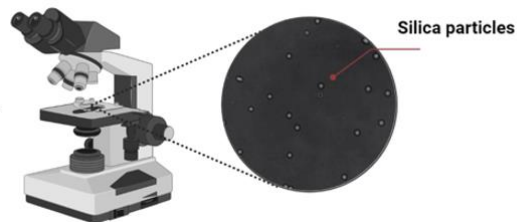


$$MSD \equiv \langle (\vec{r}(t + \tau) - \vec{r}(t))^2 \rangle = \beta \tau^\alpha$$

Macro- Dilatational Rheology

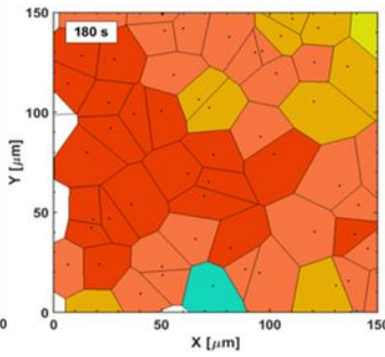
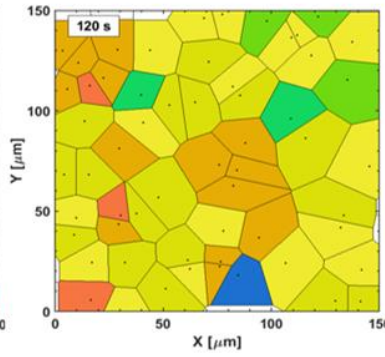
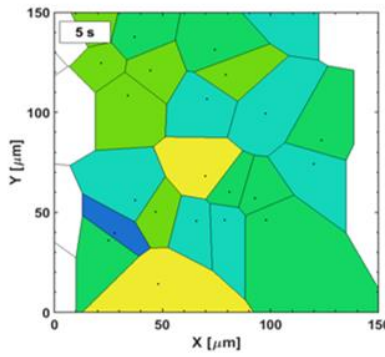


Aging

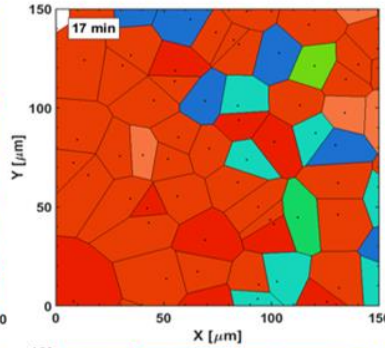
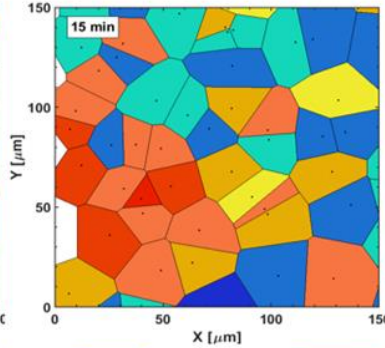
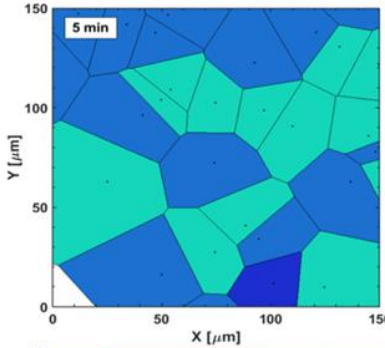


- IA: Interfacial Active Asphaltene
- A: Asphaltene
- PA: Partially Active

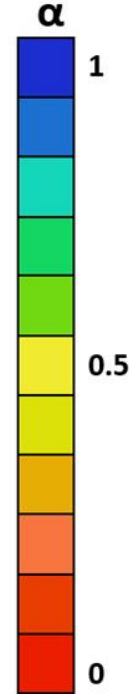
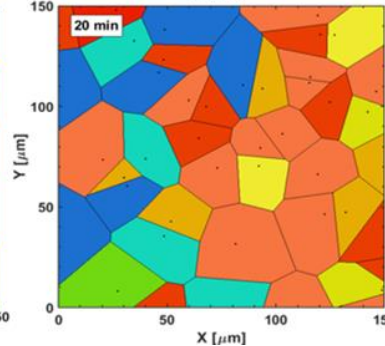
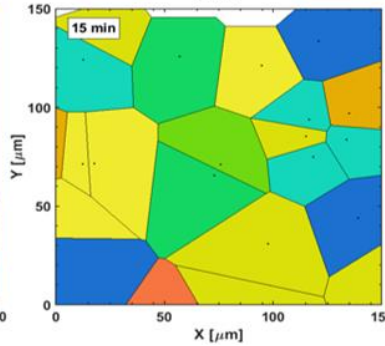
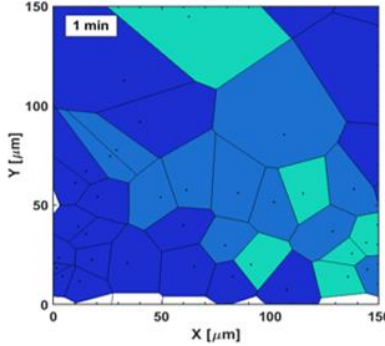
IA



A

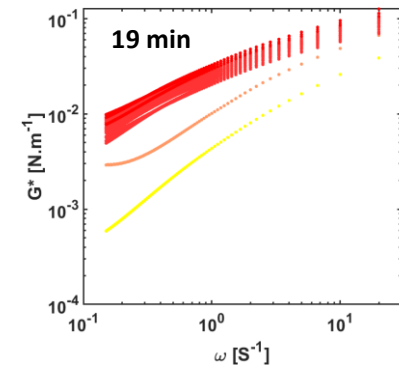
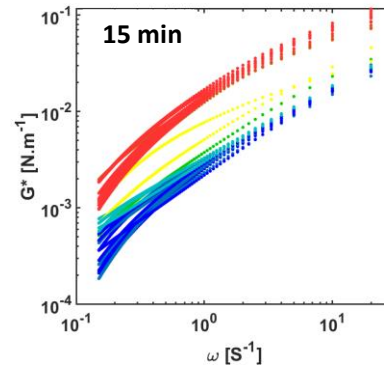
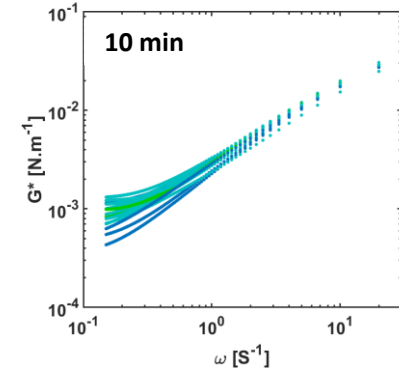
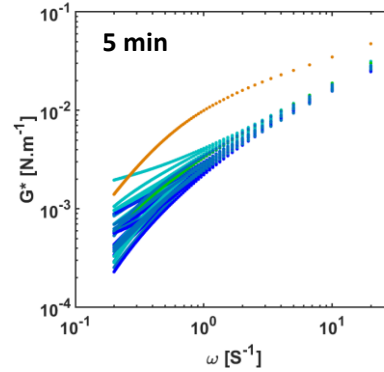
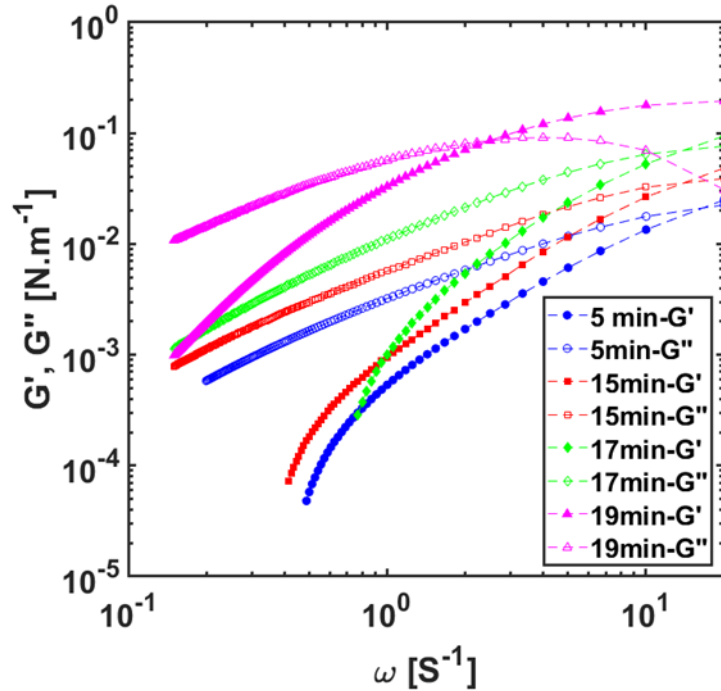


PA

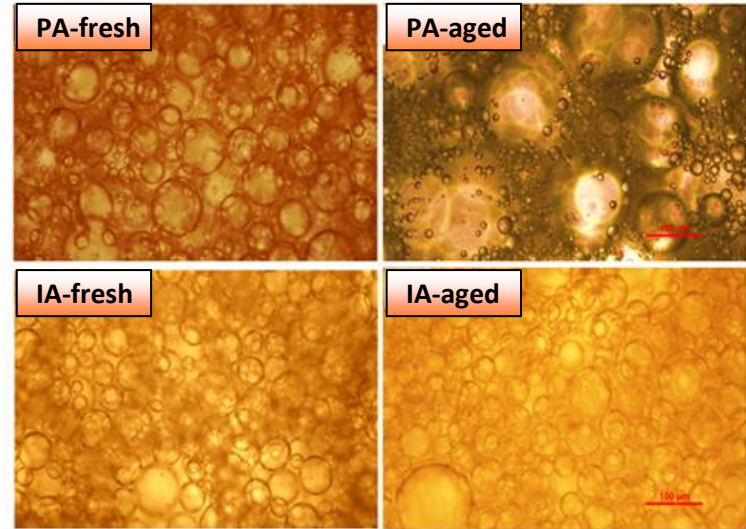
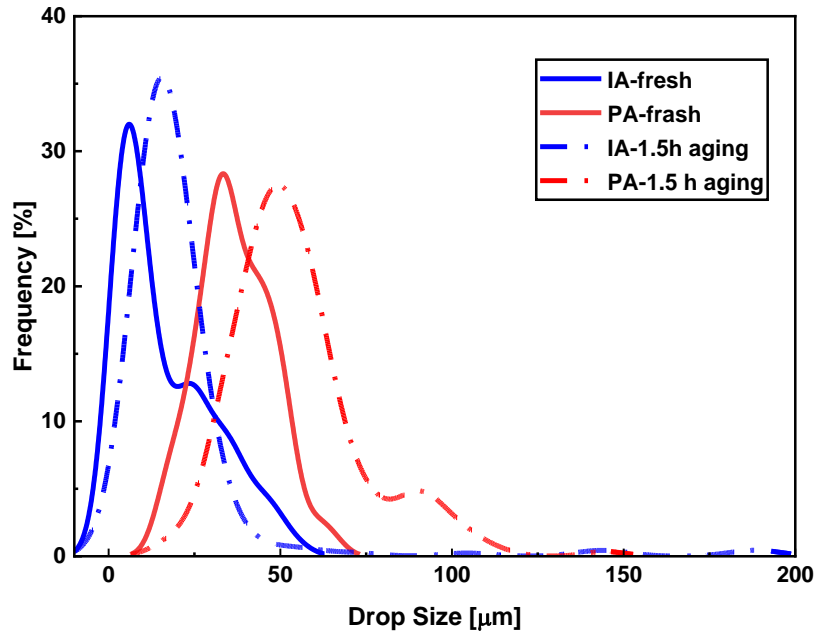


Heterogenous
Interface

Asphaltene Interfacial Rheology



Emulsions



- A novel Interfacial Microrheological methodology
- Significantly faster film formation in IA fraction
- Micromechanical heterogeneities at interfaces in all fractions
- Smaller average drop size both in fresh and aged emulsions in the IA vs PA fraction.

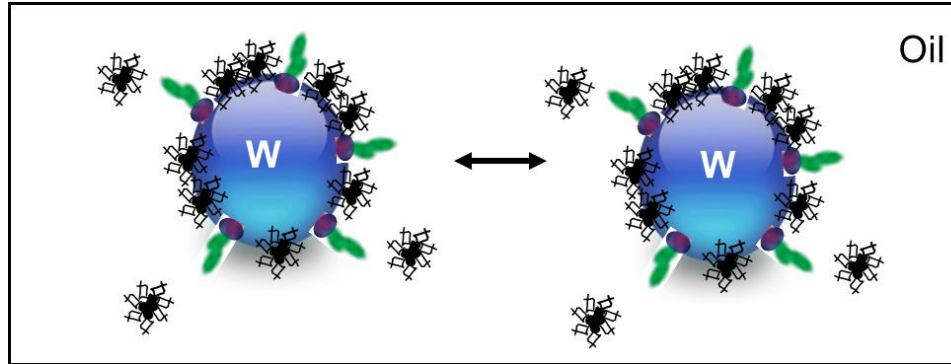
Interfacial Microrheology to Explore Emulsion Treatments

Chemical
Treatment

Thermal
Treatment

Electrostatic
Treatment

Ultrasound
Treatment



Thank you!

gnatale@ucalgary.ca