

Understanding Self Assembly Under Reservoir Like Conditions

Thomas Fitzgibbons¹, Richard Gillilan², Qingqiu Huang³

¹Analytical Sciences, The DOW Chemical Company ²CHESS, Cornell Univ, ³Cornell University

TCFitzgibbons@dow.com

Nonionic surfactants are used in many applications including cleaning and emulsification. One application where they are also used is in the enhanced oil recovery industry where surfactant are pumped down hole and used to alter both the wettability of the rock formation as well as solubilize oils that are trapped in the formation. The self assembly of nonioninc surfactants are known to be affected by numerous external stimuli such as temperature, pH, and ionic strength. When being used in EOR based applications though surfactants are also exposed to extreme pressures of upwards of 100 MPa. In this presentation we will showcase the effect of pressure and ionic strength on the self assembly behaviors of nonionic surfactants in solution using the unique high pressure SAXS setup at the MAC CHESS beamline. We verified many previous efforts that demonstrate the low compressibility of spherical micelles. However, we show that pressure has a large effect on the self assembly of nonionic surfactants after they undergo the sphere to rod and rod to worm transitions that are observed as an effect of ionic strength. These changes as a function of pressure may have unique effects on the rheological behavior and resulting performance of the fluid within the rock formation.