ECE Seminar

Friday, November 13, 2015 (12:30 pm)

Engineering Building 2, Room W122

"New Asphaltene Nanoscience and Its Impact on Reservoir Characterization"

Dr. Oliver C. Mullins (Schlumberger)

Dr. Oliver C. Mullins is a Science Advisor in Schlumberger. He is the primary originator of Downhole Fluid Analysis (DFA) in well logging. Dr. Mullins also leads an active research group in petroleum science leading to the Yen-Mullins model of asphaltenes and the FHZ EoS. His current interests include utilizing the new DFA technology and new asphaltene science to perform novel reservoir evaluation. He has won several awards including the SPWLA Gold Medal for Technical Achievement. He authored the award-winning book The Physics of Reservoir Fluids; Discovery through Downhole Fluid.

Abstract. Crude oils consist of gases, liquids and solids, the asphaltenes. The gas and liquid constituents of crude oil are chemically well understood and their theoretical framework can be satisfactorily treated by cubic equations of state. In contrast, the asphaltene have been grossly misunderstood precluding any theoretical treatment of asphaltene gradients in reservoirs. In recent years, asphaltene science has undergone a renaissance with many of the advances being subsumed in the "Yen-Mullins model which consists of asphaltene molecules, nanoaggregates and clusters of nanoaggregates. Various molecular diffusion and mass spectral measurements show that asphaltene molecular weights are ~750 (range 500-1000) Daltons. Molecular diffusion measurements originally established the predominance of (but not limited to) one polycyclic aromatic hydrocarbon (PAH) per molecule, now strongly supported by laser mass spectral studies. Recent, ultrahigh resolution molecular imaging supports this key finding. This molecular architecture yields nanoaggregates with <10 aggregation number as proven by recent laser mass spectroscopy results. High-Q ultrasonic studies were first to show that asphaltene nanoaggregates form at 10^{-4} mass fraction. SANS and SAXS studies confirm these small asphaltene nanoaggregates as well as clusters of nanoaggregates; DC-conductivity studies support all these findings of the size and aggregation concentration. Clusters of nanoaggregates form at ~10^{-3} mass fraction as shown by a flocculation kinetics and other measurements. Moreover, in a recent breakthrough oil-water interfacial science along with asphaltene molecular orientation studies in Langmuir-Blodgett films prove consistency with the Yen-Mullins model providing a way forward to investigate more challenging interfacial concerns.

ALL Engineering and NSM Students are INVITED! (Pizza will be served at noon!!)