TEXAS A&M UNIVERSITY at QATAR

Chemical Engineering Program

(Chemical Engineering Program)

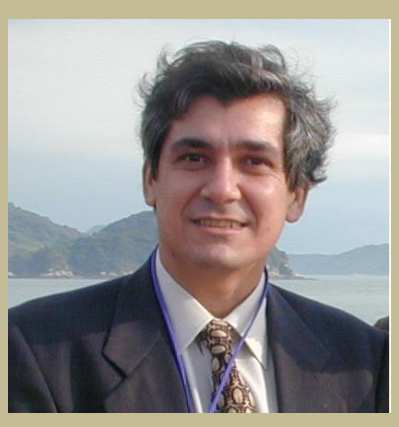
Thermodynamic Properties of Colloids

Prof. Frederico W. Tavares

18 April 2011

12 -1 pm

Lecture Hall 238



Frederico W. Tavares is Professor of Chemical Engineering at the Federal University of Rio de Janeiro, in Brazil. In academia since the early 1980's, he has taught several courses on thermodynamics, separation processes, and physical-chemistry. He has supervised or co-supervised 15 M.Sc. dissertations and 11 Ph.D. theses, and has co-authored more than 80 journal publications. His research interests focus on using molecular simulation and statistical thermodynamics to develop equations of state for non-electrolyte and electrolyte systems, thermodynamic models for confined fluids and colloidal systems.

Particle aggregation and precipitation are directly related to the free energy (potential of mean force) between colloidal particles immersed in a medium. Using the McMillan-Mayer framework, this free energy is used to calculate phase diagrams and thermodynamic properties for colloidal systems. In this seminar, we present calculations for describing the stability of water-in-oil and oil-in-water emulsions. Water-in-oil emulsions can show phase diagrams similar to those observed in molecular systems, so that colloid-diluted and colloid-concentrated phases can coexist in thermodynamic equilibrium at a given temperature, salt concentration, and external electrical field. We have found results that agree with trends of experimental and industrial observations, and may provide a better understanding of water-in-oil emulsion stability. We have also implemented the finite volume method to solve modified versions of the Poisson-Boltzmann equation for two unlike colloidal particles immersed in an electrolyte solution, including sphere-sphere, plane-plane, and plane-sphere geometries. Using this approach, it was possible to capture the important physics of the oil-in-water emulsions (or protein solutions). We have demonstrated, for example, why the double layer force between charged colloidal surfaces in electrolytes can be highly ion specific and why the Hofmeister series depends on the pI of proteins.

FOR MORE INFORMATION:

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