Department of Chemical Engineering, IIT Kanpur

SEMINAR

Speaker : Prof. V. Kumaran,

Chemical Engineering Department,

Indian Institute of Science, Bangalore

Topic : Rheology of Lamellar Mesophases

Date : Friday, March 2, 2012

Place : L-5, Lecture Hall Complex

Time : 16:00 to 17:00

All are welcome

Tea will be served at 15:45 near L-5

Abstract:

The modeling of lamellar mesophases is complicated due to the two-way

coupling between structure and rheology. A perfectly aligned lamellar

phase, for example, exhibits fluid like behavior when the normal to the

lamellae is along the shear or vorticity direction, but has a solid

like resistance to flow when the normal is along the flow direction. In

addition, even though a perfect defect free stack of layers is the final

equilibrium state, real samples are rarely defect free due to kinetic

constraints. The lamellar spacing is typically small compared to

macroscopic scales (the distance between layers in lyotropic liquid

crystalline phases is usually a few hundred Angstroms and a macroscopic

sample contains 104−106 lamellae), and so a flowing lamellar mesophase

cannot be modeled using a microscopic description. It is necessary to

use different simulation techniques (molecular, mesoscale, macroscale)

for accurately capturing the rheology of lamellar phases. First, we

present a multi-scale modeling methodology to link molecular and

mesoscale simulations. A mesoscale model is then used to examine the

rheology of a lamellar phase under a linear shear flow. For

sufficiently large system sizes, the final steady state is not a

perfectly aligned state, but rather a disordered state where there is a

dynamical balance between the annealing of defects under shear and the

spontaneous creation of defects.

About the Speaker:

Prof. V Kumaran. obtained his B.Tech in Chemical Engineering from IIT

Madras in 1987 and PhD in Chemical Engineering from Cornell university

in 1991. After a post-doctoral stint at UCSB, he joined the Indian

Institute of Science Bangalore in 1993, where he is now a Professor. His

research areas broadly focuses on molecular studies and macroscopic

applications of complex fluids and complex flows. He has been the

recipient of many awards and honors including the Shanti Swarup

Bhatnagar Prize in Engineering (2000), JC Bose National Fellowship

(2007), and is an elected Fellow of all the major Science and

Engineering acadmies of India. He also serves in the editorial board of

Soft Matter and Acta Mechanica.