NUS National University of Singapore | Department of Mechanical Engineering
Faculty of Engineering

You are cordially invited to our:
Department Seminar

Topic:	**Organization and Assembly of NanoMaterials through the Use of Polymers**
Speaker:	**Dr. Minhao WONG** Chevron Japan Ltd
Date:	**1 October 2014, Wednesday**
Time:	**12.00pm to 1.00pm**
Venue:	**E3-06-01** *(map of NUS can be found at http://map.nus.edu.sg/)*
Host:	**A/Prof. Christina Lim**

Abstract

Imagine you are a bricklayer. You dump a wheelbarrow full of bricks onto the ground and without missing a beat; the bricks start to lay themselves up into a brick wall. Science fiction? Yet this is exactly what happens with α-ZrP (zirconium phosphate) nanoplatelets dispersed in solution that self-assemble into smectic phase when spray-coated onto substrates. When applied on polyimide films, these spray-coated smectic α-ZrP/epoxy exhibit excellent gas barrier properties with consistent performance in low and high humidity conditions. This is due to the highly ordered nanoplatelets that are aligned parallel to the substrate, forcing gas molecules to traverse a tortuous path resulting in low gas permeability.

It is thought that the rheological properties of smectic α-ZrP/epoxy liquid is critical to this self-assembly process. Each nanoplatelet is tethered by oligomers that form a dense brush layer. In this seminar, the speaker will present results that suggest as the nanoplatelets form ordered stacks, the densely packed oligomer brush layer interdigitates with neighboring brush layers, which rupture under shear. Rheological measurements suggest the ruptured brush layers reversibly re-connects after some time as the highly ordered smectic structure "self-heals". This phenomenon is responsible for the highly stable arrangement of nanoplatelets. At very high concentrations, the smectic α-ZrP/epoxy liquid exhibits extreme shear thinning, (i.e. viscosity drops under stress), good processability and self-assembly. This is a markedly different behavior from other filled polymers, where gelation or jamming occurs at high particle loading.

The speaker will also show how exfoliated α-zirconium phosphates (ZrP) nanoplatelets of large aspect ratios tethered by polyoxyalkyleneamines self-assemble into photonic structures in organic solvents, giving rise to iridescence with brilliant colors that is tunable by adjusting the concentration of nanoplatelets. Oligomers or short polymers tethered to the surfaces of spherical ZnO (zinc oxide) nanoparticles allows nanocomposites to be dispersed in melt-processing, yielding a material that exhibits tunable properties in refractive index, glass transition temperature and energy bandgap as a result of their linear dependence on ZnO concentration.

About the Speaker

Dr. Minhao WONG graduated in 2013 with a Ph.D. in Materials Science and Engineering from Texas A&M University. He is currently an automotive engine oil engineer working for Chevron Japan. Previously, he obtained an M.S. in Mechanical Engineering from Texas A&M and a B.Appl. Sci. from Nanyang Technological University, Singapore. After obtaining his M.S., he worked for Kaneka Japan Corp. as a polymer scientist. His research interests include tribology of nanomaterials, functional nanocomposites and the surface modification of colloidal nanoparticles with oligomers and polymers for the controlled assembly of mesomorphic structures.

Admission is free. All are welcome to attend.