DEPARTMENT OF MATERIALS SCIENCE & ENGINEERING

NUS National University of Singapore

Synthesis of Multicompartment Nanoparticles

by **Prof. Alex M. van Herk**

Date: 04th February 2009 (Wednesday)
Time: 12:00pm to 1:00pm
Venue: EA-02-11 (Executive Seminar Room)

Abstract

The In the field of encapsulation of many types of particles like pigments, fillers and clay particles [1,2] tremendous progress has been made and applications of encapsulated inorganic particles are known, for example in car coatings. Core-shell latex particles are applied for many decades. Encapsulation of all kind of materials like pigment particles, filler particles and magnetic particles is known.
A new challenge is in the encapsulation if clay platelets striving towards a high aspect ratio of the resulting nanostructured particles. One is struggling with surface tensions there and the thermodynamic driving force to small surface area. Similar problems exist in the field of vesicle polymerization [3]. After careful studies it turned out to be very difficult to produce a thin wall of polymer inside the hydrophobic domain of the vesicle double. The most common structure produced is that of the parachute, a latex particle connected to the vesicle structure. Apparently only with strong covalent bonds between the surfactant and the polymer one is able to produce hollow particles through vesicle polymerization. The field of vesicle polymerization opens many possibilities to produce many different and interesting new nanostructured particles. The phenomenon of phase separation in latex particles not only is controlled by thermodynamic factors (mainly interfacial tensions) but only by kinetic factors (rates of diffusion linked to the local viscosities). Specialty applications like intraocular eye lenses bases on transparent latices are showing the enormous potential of nanocomposites in the area of specialties [4]. So the field of emulsion polymerization is maturing to a science where control on a nanolevel becomes common practice and moreover the synthesis and application of these nanostructured particles can be on bulk scale (in contrast to the single molecule manipulation nanotechnology).
Added to this is the introduction of controlled radical polymerization techniques as an additional means to control molecular microstructure and morphology in latex systems.It will be shown that many different multicompartment structures can be produced while applying the general principles of thermodynamics and kinetics in emulsion polymerizations. One example are the so-called nanobottles where a hollow structure is combined with a latex particle, making a lid for the ‘nanobottle’.

Prof. Alex M. van Herk Speaker

Alex van Herk (1956) is full professor in polymer chemistry in Eindhoven and visiting professor at the University of Göttingen (Germany). He graduated from the Free University of Amsterdam on the kinetics of ligand substitution reactions in vitamin B12 and joined the Eindhoven University of Technology in 1986 where he is active in the area of emulsion polymerization, polymerization kinetics, nanocomposites and alternative sources of initiation in polymerization processes. He is a member of the IUPAC working party on modelling of polymerization kinetics and a member of the international polymer colloids group. Since June 2001 he is director of the educational program in the faculty of chemical engineering and chemistry in Eindhoven. Furthermore he is chairman of the industrial liaison program emulsion polymerization (SEP). At present he is visiting professor in the department of Chemistry at the National University of Singapore

Dr Xue Jun Min Host

All are Welcome!