C2P2
CHEMISTRY, CATALYSIS, POLYMERS & PROCESSES

Scale-up of polymerisation in dispersed media

We are looking for a motivated candidate wishing to do a postdoctoral fellowship on the scale-up of emulsion polymerisation processes. This project involves a combined modelling and experimental approach to understanding the impact of a change of scale (upwards and downwards) in the area of emulsion polymerisation.

It is expected that the project will begin in the fall of 2015 (any time after September)

Interested candidates should send a C.V. and letter of motivation to:

Dr. Timothy F.L. McKenna
Timothy.mckenna@univ-lyon1.fr
http://www.c2p2-cpe.com/staff.php?name=mckenna

This project will be carried out in collaboration with Dr Nida OTHMAN (http://hal.archives-ouvertes.fr/NIDA-SHEIBAT-OTHMAN) of the LAGEP: Laboratory of Process Control and Process Engineering, and Dr Thomas BOUCHER of ARKEMA

Location: **C2P2 (LCPP Group; www.c2p2-cpe.com),** and the **LAGEP (http://www.lagep.cpe.fr/wwwlagep7/?lang=fr)** at the ESCPE on the campus of the Université Claude Bernard – Lyon 1 in Villuerbanne, France.

Context: Polymer latexes, colloidally-stable dispersions of nano-scale polymer particles in a continuous medium, are used in a tremendous range of applications, including paints, adhesives and protective coatings. Such products are made either by carefully controlling the nucleation of particles during different phases of the reaction, or using phase inversion methods. In the first case it is extremely important to obtain precise control over the local concentrations of surfactant, initiator and other species. In the second case, one adds a solution of surfactant to an organic phase, and the uniform dispersion of the surfactant ensures a uniform PSD.

In either case, one of the major impediments to the rapid and direct transformation of laboratory results into commercial products is "scale-up" – i.e. the change of reactor size form fractions of a litre to several cubic metres. An important consideration in the scale-up procedure is the change in process-critical length and time scales arising from changes in the process scale; a change in production scale will change the time required mix reactants that are introduced into the vessel.

Classical heuristics, or rules of thumb, only provide a starting point for scale-up strategy. However, the wide spread use of computational fluid dynamic (CFD) software has provided process engineers an inexpensive means of obtaining detailed information about fluid flows, and can be used to understand the impact of changing length scales on mixing times. This project focuses on the application of CFD simulations combined with population balance models (PBM) of particle and droplet formation to develop a coupled approach to the scale-up of latex systems. It will be experimentally validated on reactors of different volumes (0,1 – 10 litres) and different agitation rates and types.

Qualifications: The successful candidate will have completed a PhD or equivalent in chemical engineering. An understanding of CFD simulations is a must, and knowledge of emulsion polymerisation processes would be considered an advantage.