



University of
South Australia

Applied Centre for Structural & Synchrotron Studies (ACeSSS) and
Laser Light Scattering & Materials Science Group (LLSMS)

PhD Scholarship

To Study

Crystal Growth Additives for Enhanced Gibbsite Growth and Agglomeration

A postgraduate scholarship is available in the Division of ITEE at the University of South Australia to pursue a PhD in the exciting multidisciplinary and important area of mineral science. This project will involve collaboration between the research group of ACeSSS (Applied Centre for Structural and Synchrotron Studies) and Applied Physics, both of which have a strong background in colloid and materials science. Australia is one of the world's major producers of alumina. Alumina and aluminium products are the country's third largest revenue earner and generate income exceeding \$5.7 billion per annum. The Bayer process has been used for alumina extraction from bauxite ores for more than a century and involves a slow gibbsite crystallisation step. The physical properties of alumina are currently ranked by smelters as being of the greatest concern as the fines content has a significant impact on smelting sub-processes. It is only through a fundamental understanding of the exact mechanism of gibbsite precipitation, which includes the three major steps of nucleation, growth and agglomeration, under Bayer conditions, that new control techniques can be developed to resolve this issue.

Recently, the impact of a polymer additive on a system designed to study secondary nucleation and growth conditions, has been examined. The results have revealed that the polymer is an effective nucleation controlling reagent. The polymer additive has significantly enhanced the crystallisation rate and inhibited the effect of organics at the solid/liquid interface yielding considerable gibbsite agglomeration/coarsening. However, the exact mechanism by which this occurs is not yet known. This project will focus on identifying the mechanisms of interaction of the additive with gibbsite surfaces during nucleation and growth. In particular, the effect of the additive on gibbsite interfacial structure, surface and adsorption energy, as well as solution structuring will be examined. A series of modern techniques are available for this study. These include synchrotron and laboratory small angle x-ray scattering (SAXS), small angle neutron scattering (SANS), light scattering (static and dynamic), ToF-SIMS, infra-red microscopy, scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS) X-ray diffraction (XRD) and UV-Vis microscopy.

Applicants should have an Honours degree or Bachelors degree with relevant experience in physics, chemistry, chemical engineering, materials science or a related field. Australian or New Zealand citizenship is required.

Stipend: Tax-free \$26,669 p.a. Allowances are also available for relocation and thesis preparation. There will be opportunities to attend national and international conferences relevant to the research.

Application Deadline: 31st of October 2009.

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