

## **PhD Student in Chemistry of Interfaces, Dnr: 2788-2011**

### **Project title: "Solid-State NMR and ab-initio calculations on rare earth metal complexes."**

The Division of Sustainable Process Engineering in collaboration with the Department of Physics at Oulu University, Finland, is looking for a PhD student within the research subjects Chemistry of Interfaces (LTU) and Physics (Oulu University).

#### **Project description**

In 2010 European Raw Material Initiative placed Rare Earth Elements (REE) on the list of leading strategic metals, since they have a wide range of important high-technology applications in materials chemistry and physics and the demand for REE is increasing globally with the development of green technologies. Currently, it is a challenging task to extract, concentrate and separate REE, because they are usually spread at low quantities in different minerals and have very similar physico-chemical properties. Present processing methods involve many extraction and separation steps, which use toxic solvents and reagents having a large negative impact on the human health and the environment.

The proposed project will combine solid-state Nuclear Magnetic Resonance (NMR) spectroscopy and ab-initio quantum mechanical calculations to obtain detailed parameters for REE complexes with commonly used flotation collectors, as well as with anionic ligands from novel ionic liquids, recently developed in our group. We will study further how these ligands interact with mineral surfaces and leach REE. Hyperpolarization techniques will be used to enhance NMR signals from surface adsorbed species. The outcome will be useful for development of novel "greener" technologies for extraction, concentration and separation of REE.

The project has importance for mining industries (in Sweden and Finland) and is financed in part by the Centre of Advanced Mining and Metallurgy (CAMM) at Luleå University of Technology.

The experimental work is mainly expected to take place in Luleå and the theoretical calculations in Oulu and the student is expected to spend approximately half the time (two + two years, i.e. four years in total) at each university.

The student is expected to take part in teaching activities at the two institutions. The student will be awarded with both a Swedish and a Finnish doctoral degree.

#### **Qualifications**

The candidate should have a MSc degree in Chemistry, Chemical Engineering or Physics. Previous experience with NMR spectroscopy or ab-initio calculations is an advantage. The candidate should be good in written and spoken English and good communication skills in Swedish is an advantage.

#### **Information**

Professor Oleg Antzutkin ([olan@ltu.se](mailto:olan@ltu.se)) and Dr Anna-Carin Larsson ([acla@ltu.se](mailto:acla@ltu.se)), Chemistry of Interfaces, Luleå University of Technology, Sweden

Professor Jukka Jokisaari ([jukka.jokisaari@oulu.fi](mailto:jukka.jokisaari@oulu.fi)) Department of Physics, Oulu University, Finland

#### **Application**

The application should be written in English and submitted to LTU's Registrar: [registrator@ltu.se](mailto:registrator@ltu.se)

#### **Deadline**

Due date for application is January 22, 2012, and the project is planned to start in March 2012.