The MEAB Group involved in Rare Earth Recovery

- **MEAB participates in two EU Projects**

EURARE (Grant agreement: 309373): **Development of a Sustainable Exploitation Scheme for Europe's Rare Earth Ore Deposits.**

EU Work Programme topic FP-NMP-2012-4.1-1: New Environmentally Friendly Approaches in Minerals Processing

Concept and Objectives

Raw materials are essential for the functioning of the economy of industrialised regions like the EU. The global demand for non-energy raw materials has experienced an unprecedented growth in the 20th century, with the United States of America and Europe being the dominant users of raw materials. Industrial sectors such as automotive, aerospace, machinery, chemicals and construction are completely depended on access to certain raw materials. The notable increase in raw material consumption during the last years, mainly by the so called BRIC economies, with the acronym standing for Brazil, Russia, India, and China, the geographically uneven distribution of earth's mineral resources, the intense exploitation of most of the sizeable and high grade deposits in Europe and the restrictions on foreign investments and exports recently posed by China, make the supply of raw materials at reasonable prices one of the greatest challenges for the EU in the 21st century.

With numerous European industries heavily depended on imported raw materials of Rare Earth Elements (REE), there is a need for EU to secure a viable supply of REE minerals as well as develop from the ground up the currently non-existent European REE extraction and processing industry. The goal of the EURARE project will be

- to characterize the potential REE resources in Europe; and

- to research, develop, optimize and demonstrate technologies for the efficient and economically viable exploitation of currently available European REE deposits with minimum consequences to the environment.

In the EURARE project, the mineral processing technologies currently used for the REEs minerals will be investigated for representative European REE ores, with a tendency for improvement by adopting new approaches for the complete ore utilization and minimal environmental consequences, establishing integrated mineral processing systems, with zero or close to zero tailings.

The current state-of-the-art processes for REE extraction follows complicated, energy and resource intensive technologies. The EURARE project aims in developing novel cost-effective and resource-efficient REE extraction process, tailored specifically for European REE ore deposits as well as for European health, safety and environmental protection standards.

Summarising, the REE supply chain is characterized by serious risk as it is currently monopolized by China, by constantly increasing demand, especially due to REE use in electronic and green technology applications, and finally by severe recycling restrictions. REE are used either in products with long service life (e.g. wind turbines) or in products with short service life (e.g. cell phones), but in such low concentrations that prohibit an effective recycling schema.

The engagement of MEAB (Germany)

In the EURARE project, MEAB will be involved in the development of separation techniques of rare earth elements (REE), based on state-of-the-art solvent extraction technology. More importantly MEAB will be the project leader of design, construction and operation of the mobile pilot plants to be used for the REE extraction and separation demonstration activities. The pilot line will be set up by MEAB in Aachen, Germany in cooperation with RWTH and SLU and will demonstrate the technologies developed. The plant will include:

1. A leaching unit, capable of processing 4 to 8 kg of solid per 5 -10 hour batch with an average feeding rate of 1kg/h.
2. A liquid-solid separation unit capable of processing at flow rates from 5 to 10 l/h, which will be complemented by pH adjustment tanks and fine filtration units.
3. A REE solvent extraction separation unit with mixer-settlers having an active mixer volume of 0.12 l, an active settler volume of 0.48 l and a total processing flow (capacity) of 10 l/h.
4. A precipitation unit, followed by an appropriate liquid-solid separation unit.

The plant will be designed and constructed so as to fit in a single container in order to produce a mobile plant suitable for field testing. The total engagement of MEAB will be 43 man months during four years.

RECYVAL-NANO (Grant agreement: 310312): **Development of Recovery Processes for Recycling of valuable Components from FPDs (In, Y, Nd) for the Production of High Added Value NPs.**

EU Work Programme topic FP7-NMP-2012-4.1-2: Innovative Recycling Technologies of Key Metals in High-tech Applications

Concept and Objectives

Waste electrical and electronic equipment (WEEE) is considered to increase drastically in the coming decades. WEEE contains considerable quantities of valuable components used in high-tech applications that currently are not recycled. Europe needs to improve and develop recovery, recycling and reuse of critical materials in order to avoid the dependency on imports, high prices and risk of supply imposed by countries owning mineral reserves. The RECYVAL-NANO project will develop an innovative recycling process for recovery and reuse of indium, yttrium and neodymium metals from flat panels displays (FPD), one of the most growing waste sources. The project will be addressed not only to the recovery of these critical elements, but also the recycling process developed will result in the direct extraction of metal-organic precursors for direct reuse in the production of high added value nanoparticles that is ITO, Y2O3:Eu3+ and Nd-Fe-B. The project will develop an integral study of the recycling process, starting with logistic issues of the waste collection, optimising mechanical sorting technologies and developing innovative ones for the recovery and concentration of smaller fractions containing indium, yttrium and neodymium. In addition, simplified solvent extraction routes based on tailored chemical extraction agents able to extract a 95 % of the key metal in a metal-organic extracted solutions will be developed. These extracted solutions will be used as precursors in the direct production of advanced nanoparticles. RECYVAL-NANO will validate the recycling process developed through the construction, optimisation and demonstration of full pilot lines for mechanical recycling of FPDs (500 kg/h) and hydrometallurgical metal recovery processes (500 g/h). Finally, the demonstration of the superior performance application of ITO, Y2O3:Eu3+ and Nd-Fe-B nanoparticles

in electronic applications of transparent conductors, LEDs and permanent magnets respectively will complete the entire cycle of the project.

The engagement of MEAB (Sweden)

As an expert in applying its hydrometallurgical knowledge into the design and construction of the suitable equipment for the recycling processes, MEAB will support the definition of starting conditions for the solvent extraction methodology as well as main modules or needed equipment. MEAB will be the main responsible of the design, optimisation and construction of a pilot line for extraction of key metals and production of metal-organic precursors. They will also be responsible for the demonstration of the pilot line constructed. Finally, MEAB will lead the activities regarding techno-economic analysis of the processes and products developed and the dissemination activities. The total engagement of MEAB will be 40 man months during four years.