



STIFTELSEN för  
STRATEGISK FORSKNING

## The Swedish Foundation for Strategic Research (SSF) announces research group grants for research on *Innovative Technologies for the Extraction of Metals from Raw Materials*

The Swedish Foundation for Strategic Research (SSF) invites applications for grants to support research into innovative raw material technologies. The grants are group grants - funded for five years with SEK 4-5 million per annum and per grant, up to a maximum total sum of SEK 80 million.

The objective of projects supported by the program should be the development of a technology, which can be used commercially, to extract valuable metals from by-products, waste and low-content raw materials. Alternatively, the objective may be to extract toxic metals from contaminated ground which can then be declared clean and thus made exempt from regulations regarding disposal. The technology, if developed, will have the potential to spearhead development of a sustainable society, where the flow of production is optimal and where neglected and low-content by-products can be used as new raw materials.

The project must fulfill the demands of SSF for high scientific quality and strategic relevance, as well as a number of further basic conditions defined below under "Formal criteria".

### **Background**

#### **Scope of demand**

In industrialized countries, each individual consumes on average more than one thousand tons of metals and minerals during their lifetime. The demand for metals, and the need to recycle metals, is increasing. In recent years, the demand for "new" strategic and important metals has grown, e.g. for alloys and catalytic converter metals. Most recently, an inventory and analysis of the scope of demand has been performed in the EU. The following elements and minerals have been identified as being of particular importance, based on supply and demand: antimony, beryllium, cobalt, fluorite, gallium, germanium, graphite, indium, magnesium, niobium and tantalum, platinum group metals,

rare earth metals and tungsten. Other elements in demand include lithium, nickel, vanadium and uranium.

An investigation by the EU Commission has shown that:

- Approximately 40 different raw materials are needed to manufacture a cell phone, including lithium, tantalum, cobalt and antimony,
- A computer contains approximately 60 raw materials, including rare earth metals,
- A hybrid car contains several kilograms of rare earth metals (battery, electric motor and exhaust system),
- Metal hybrid batteries are based on several metals, including rare earth metals, lithium and nickel,
- Many metals are mined in only a small number of countries and high-content raw materials are rare.

### **New raw materials**

A significant amount of by-products from metal processing are classified as waste and are sent for disposal. Certain metal-containing waste products are transformed or destroyed by incineration, and the remains of this process are also sent for disposal. Large quantities of products and materials contain low amounts of valuable metals, such as slag and ash from different processes (including incineration), precipitants from water purification, acid bath deposits following the surface treatment of metals, ore in mine deposits, earth contaminated with metals, etc. Many natural products contain low quantities of metals which makes them interesting potential raw materials. Certain waste, for example, electronic products, is already used today for the extraction of valuable metals. It is of great interest for both society and for individual companies to extract or recycle metals from this wide variety of products, in consideration of both the need to recycle materials and the benefits of using new potential raw materials. It is also important for society to be able to extract toxic metal from polluted ground to enable a declaration of purity of earth, which otherwise must be classified and discarded as waste.

Metal-containing by-products with a potential as raw materials may be differentiated and classified as follows, with particular emphasis placed on technical and economic costs in relation to supply and demand:

1. Material that can be directly used - the metal content is sufficiently high, for example scrap metal or slag fractions with high metallic content.
2. Material that cannot be directly used - the metal content is too low, or too inaccessible for the material to be used directly, but too high for the material to be declared clean.



3. Material that can be declared clean - the metal content is low, and is consequently of low value. If the material can be declared clean directly or after simple treatment, it may be reused for example as filling.
4. Material containing some valuable metal of interest, but at low levels or in an inaccessible matrix.
5. Natural products, precipitants, sediment etc containing a low content of metals in demand today.

### **New techniques**

The extraction of metals in all these categories, especially categories (2), (4) and (5), demands modified or new techniques that can liberate the metals from the matrix as well as differentiate and concentrate those metals which are desirable to recycle or isolate – all at a justifiable cost. Environmentally acceptable treatment of by-products procedure must be a part of the overall process. In particular, in categories (4) and (5), low-content raw materials (by-products, natural products) also demand:

- Techniques for the separation and isolation of metals present at low levels, either in a discrete form or evenly distributed in a matrix in combination with other metals.
- Strategies and handling procedures that minimize the generation of new by-products; a closed process or one with minimal emissions, recycling of process chemicals etc.
- A process that is economically justifiable, for operators as well as for society as a whole.

Profit is measured not only by the value of the extracted metals, but also by reduced costs in handling by-products which otherwise demand disposal or other measures, as well as by the long term benefits to society, such as recycling and management of primary, non-renewable raw materials.

### **Aims**

The practical aims of projects seeking financial support within the programme should be:

- Development and optimization of processes for *extraction* of selected metals from materials such as by-products, waste, low-content raw materials etc.
- or
- Development and adaptation of techniques for *separation* and isolation of metals during the recycling process.

In both cases, the proposed projects must also consider the demands of society and the economic and environmental consequences of the implementation of the process at full scale. Applicants shall demonstrate an ambition to use the results of the project for the good of society.

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**Formal criteria**

Any grants will be group grants. A group grant is defined by SSF as a project run by a number of researchers with complementary competence, from a large research group or from a small number of cooperating independent research groups, sharing a location or at different universities/university colleges or research institutes.

One of the researchers must be designated principal investigator/main applicant and is responsible for coordinating scientific operations. If the main applicant is actively working at a research institute, at least one co-applicant should be working in a university/university college.

The project will be funded for an initial period of 3 years after which an evaluation will take place to decide if funding should be extended. Please note that the project plans presented in the applications, should cover a period of five years. Applications should be submitted to SSF via the foundation's application site at <http://apply.stratresearch.se>, where guidelines on the requirements for style and content can be found.

A maximum of 25% of the grant may be used for salaries for the main applicant and co-applicants, but only to cover up to a maximum of 25 % of the salary of each applicant. Each scientist can submit only one application as main applicant in this call.

**Evaluation process**

Applications will be evaluated by an evaluation committee consisting of Swedish and foreign experts from academia and industry. A preliminary selection will be made principally on grounds of strategic relevance as well as whether they follow the required guidelines (see above). Selected applications will then be evaluated in their entirety by a group of international scientific experts with the emphasis on scientific quality (goals, choice of methods and project plan) as well as the competence of the applicants. Finally, the evaluation committee will decide on a funding proposal, which the board of SSF will consider. The decision of the evaluation committee will be based on the reports of the international experts in addition to their own evaluation.

**Preliminary time frame**

Final application date: February 25<sup>th</sup>, 2011, at 14.00 hours Swedish time

Decision for funding, estimated date: October 2011

Project start, earliest estimated date: November 1<sup>st</sup>, 2011

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