Swedish Foundation for Strategic Research

27 June 2008

The Swedish Foundation for Strategic Research calls for proposals for research group grants for research in Materials Science

The Foundation calls for proposals for five-year research group grants for research in materials science within a framework of a maximum of SEK 225 million. Applications should focus on the fields of functional coatings or light materials. (See below.)

This Call concerns a number of research group grants for strategic research work. These grants are to finance cutting-edge research of the highest international class and with strategic relevance for present and future industry in Sweden. The Foundation's research group grants will be in the range of SEK 2-6 million/annum and will finance application-initiated research. Each application should have a main applicant who will coordinate the planned project. A main applicant may present only one proposal in this call. Normally, grants will be given for a five-year period, but three-year periods may also be granted. After three years, the Foundation plans to set aside further funds for a new call within this field, so that the total sum of grants from the Foundation will be about SEK 60 million/annum for the coming years.

Importance of materials

For Sweden, the field of materials is of exceptional importance and the annual export revenue amounts to hundreds of billions of kronor. For companies like Sandvik, Volvo, Autoliv, SKF, SSAB, Kockums, DIAB, SAPA, Finnveden, Tetrapak, Stora Enso and others, as well as a large number of small and medium-sized companies, the development and use of materials is crucial. Swedish companies have been particularly successful on the world market, at times world leaders in their segment. Swedish industry is dependent on competent personnel with an education in materials science. Universities and research institutes fulfil an important function by delivering engineers and doctors with a training in materials science that is adequate for industry, and the strategic relevance of research can be strengthened by means of closer contacts between these sectors. Swedish materials research today is of a very high scientific class, which is demonstrated, for example, by evaluations made by the Swedish Research Council and the Swedish Foundation for Strategic Research.

In most areas of technology – engineering technology, electronics, construction technology, energy technology, transport and communications technology and the like – it is generally accepted today that in practice it is access to materials and their properties

that sets the limits for development. Large areas of materials technology stretch over several disciplines. Today's technological developments in general continually make new demands for higher-performance materials, materials with special or extreme properties, materials for complex functional demands and the like. These demands force the pace of development of new production methods and increasingly specialised materials with improved and sometimes completely new properties.

Investments and priorities

There are many areas of research in the field of materials, but not all are judged to be of equal importance for Sweden's future competitiveness. That is why it is vital that priority is given to research investments in areas that have a good potential for exploitation in Sweden. In all the projects proposed, theory, modelling and experiments should be integrated. The conditions for large-scale production and industrialisation should also be taken into consideration and a clear description of the benefits of eventual applications should be made. Nanotechnology is a natural component in all fields and has not been identified as a special area for investments.

Strategic relevance

The aim of the Swedish Foundation for Strategic Research is to support research in order to strengthen Sweden's future competitiveness. Among research financiers, SSF places itself between the Swedish Research Council (Vetenskapsrådet) and Vinnova, as illustrated in the diagram below. The practical definition of strategic relevance, which will be used when ranking applications, is that the research should have a clear vision for exploitation in Sweden within a time span of 5-15 years after completion of a project. In addition, applications that are assessed as being able to contribute greatly to Sweden's future competitiveness will be given higher priority than those assessed as being able to give less.

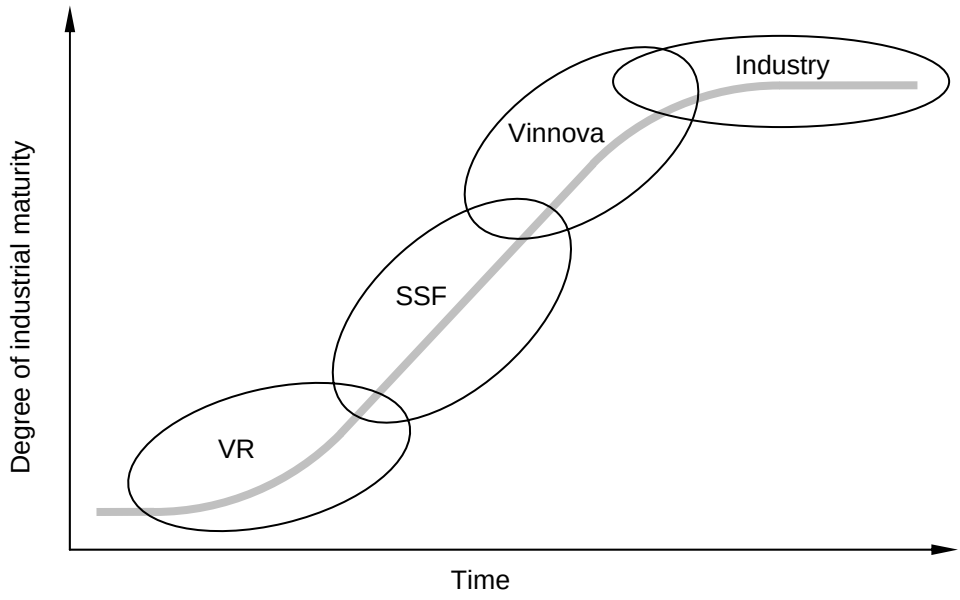

Figure 1. Illustration of the areas of priority for Swedish research financiers

Areas of technology

Functional coatings

The term functional coatings refers to coatings or surfaces made for the purpose of creating surface coatings that provide increased functionality, either through the coatings' inherent properties or through their properties in combination with substrata and their surroundings. The thickness of the coatings can typically vary from a few nanometres to a hundred or so micrometres. The coatings can have a direct function, which means that the properties as coated are those sought after. The coatings can also be designed to be used in an application that exposes them to atomic, topographical or microstructural change. In addition, they may be coatings that affect surrounding environments and/or substrata rather than that the coatings themselves are changed to any significant extent. It is of major importance that the coatings' functionality is studied in their proposed environment of use or in environments that simulate such environments. Examples of production technologies include: wet-chemical methods, CVD, PVD, plasma-spraying, electronic-ray depositing, thermal spraying, nanoimprint methods and reactive ion etching.

Great innovatory steps are often taken when surprising properties are achieved by combining the properties of separate components. It may therefore be worth while investigating whether several properties can be achieved in one and the same surface coating.

The main categories that are open for applications are:

- **Surfaces requiring functionality in demanding environments – durable surfaces**
  Durable coating on tools and moving parts is subjected to extreme stresses at least in parts of the surfaces in use. Here may be included purely tribological applications in which properties such as friction and resistance to wear are in focus. Other applications involve major structural changes in the coating caused by the phase transformations and diffusion phenomena that occur at the high temperatures and pressures in use, in combination with wear and tear. A further example of challenges is the creation of coating material or combinations of alloys of coating material in which properties like hardness are combined with robustness.

  New electrical contact material makes it possible to achieve in a better way stable contact resistance with high resistance to corrosion and wear as well as higher thermal stability than that provided by traditional metallic contact material.

- **Surfaces requiring functionality in demanding environments – chemical surroundings**
  Chemically aggressive environments put high demands on the design of suitable coating material. We may include in this category surfaces in contact with oil in gearboxes, which is of importance for the automotive industry, for example. Corrosion-resistant coatings raise the quality of construction material used in a variety of applications.

The development of future catalytic converters and their active material, and membrane processes in the chemical process industry are examples of applications in which resistance to aggressive chemicals is one of the most important design parameters for a surface.

- **Surfaces requiring functionality in demanding environments – high temperatures**
  Surface coatings that function at high temperatures are yet another category. Steel constructions can be coated with material that protects them from fire. High-temperature-resistant material is also interesting for the coating of parts of jet engines, furnaces, combustion plants, electric switches and the like. Surfaces with a combination of properties like reduced friction in mechanical parts, surfaces that withstand high temperatures and are stable in chemically aggressive environments, are also important.

- **Surfaces requiring direct functionality – electromagnetic coating**
  Coatings with electromagnetic properties can be produced with the help of various techniques. The magnetic properties of bulk material may be changed by using functional outer coatings that control the size and direction of the magnetic domains. By using laminated layers of material with different physical properties, it is possible to create tailor-made materials with new properties, for example, the surface modification of electroplate in order to improve electrical properties. Other examples of applications using layered magnetic material are the control of magnetic flows and the limitation of electric current in electrical apparatus. A wide range of applications in the fields of mechatronics, sensors, electric power, electronics, safety and the like can be seen here.

  New coatings with electromagnetic properties based, for example, on quantum-mechanical phenomena including construction methods that enable practical use are of interest. These may be used as key components in chemical, biological and medicinal applications, optical sensors and components, new high-tech process companies and the like.

- **Surfaces requiring direct functionality – porous coatings**
  Coatings with well-defined pores have many possible applications. Many new production methods are now being developed to control both the size of the pores and their arrangement in fields embracing free volumes via nanoscales up to macroscales. Examples of porous coatings are cryogels, aerogels and isoporous surfaces for applications in fields such as biotechnology and photonics.

  It is possible, by using inorganic, organic, and hybrid sungel techniques, to achieve controlled physical topography, optical effects with physical methods, at the same time as surface functionality can be used to create chemical and/or biochemical functions.

Light materials

Products that save weight and space are of central importance today. Both completely new materials and existing materials in new applications are important. Light-weight materials and light constructions contribute, among other things, to a resource-saving society through reduce weight and reduced material and energy consumption, at the same time as environmental stress coupled to emissions is lessened for the whole industrial sector. Health care and the sports sector, for example, may benefit from light constructions as well.

There is a long tradition in Sweden of developing metallic construction materials. We have major material manufacturers of synthetic polymers, but the use of these materials is increasing and new applications are being found all the time. Polymers are often of great importance in complex constructions. Furthermore, all smart textile materials are judged to be a potential niche for Sweden.

Main categories open for applications:

- **Polymer materials and composites**
  It is a major challenge to produce nano-structured composite materials. This is a key to expanding considerably the range of properties, thereby increasing the usefulness of composite materials. One line of development may be towards bio-inspired, multi-functional structures in which functional gradients are integrated into the mix of materials with geometric forms and controlled porosity. General areas are: molecular composites, composites with controlled porosity, nano-fibres with great strength in combination with hierarchically organised structures and the improvement of existing materials by using, for example, nano-fibres/particles in the matrix.

  The production of new polymer materials, mixtures and foams is of interest. New design criteria, surface finish, compatibility and material characterisation, not least long-term properties, need to be developed in this field.

  Production techniques, robust compounding and recycling, including health considerations in production, are other aspects that are central to this field.

- **Light-weight constructions**
  Innovative solutions based on metallic, light-weight materials, metal foam, composites, polymers and the like are included in this category. Design, design criteria and the optimisation of properties are high-priority development activities. Joining is a key technology. It must be possible to join together new materials, separately or in combination with other materials, in products and practically applicable constructions.

- **Textile materials**
  Technical textile materials may experience a renaissance with an expanding industry in Sweden. New textile materials can provide new combinations of properties in the shape of dirt repellence, conductivity, temperature control, sound absorption, filtering and so on. New functions can be developed using smart textiles that include, for example, comfort, aesthetics, hygiene and security aspects.

Applications

Applications are made in one step with a complete application. Applications should include a detailed description of the research project and a preliminary plan for future exploitation and should present current competence. Applications should contain a clear presentation that focuses on the research project's strategic relevance for industry in Sweden.

Applications are made via the Foundation's application portal at http://apply.stratresearch.se, which is open 1 August – 1 December 2008.

Qualifications

Applications should be made by one main applicant who should be a prominent researcher attached to a university, college or research institute. If the main applicant is working at a research institute, at least one of the co-applicants should be working at a university or college. Prospective project leaders must be prepared to take scientific responsibility for the project throughout the whole grant period. The number of co-applicants must be in reasonable proportion to the sum of money applied for, and a maximum of 50% of the grant may be used for salary for the main applicant and/or the co-applicants, but only to cover up to a maximum of 50% of the salary of each applicant.

Evaluation process

Applications will be reviewed by an evaluation committee. A first selection will be made in which the applications will be reviewed solely with respect to how well they correspond to strategic relevance and whether they follow the lines of the call. The selected applications will then be reviewed in full by a group of international scientific experts with respect to scientific quality. The result of this scientific evaluation and the strategic value of the applications will then be taken into account by the evaluation committee before putting forward a final proposal that the Board of the Foundation will decide upon.

The following priority criteria will be used:

In the first place:

- strategic importance for Sweden
- scientific quality and the competence of the applicant(s)
- assessment of goals, choice of problems and working methods on the basis of the priorities and limitations presented in the call.

Further:

- active involvement with industry
- synergetic effects with other related work, with or without support from the Foundation, and
- initiatives towards national and international collaboration between research groups

It is also vital that applications give a clear picture of the resources available and show that the group proposed will be effective.

No formal demands for co-financing are made by the Foundation.

Schedule

The last date for applications is 1 December 2008, 2 p.m. The application system opens on 1 August 2008 at http://apply.stratresearch.se.

The decision of the Foundation's Board is expected to be made in summer 2009.

Please note that the Foundation follows the principle of public access to official documents (offentlighetsprincipen). Avoid therefore sending material that at the present time may not be made public, for example anything that might prevent an application for a patent.

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