



SWEDISH FOUNDATION *for*  
STRATEGIC RESEARCH

**SSF Call for Proposals:**  
**Framework Grants for research on**  
***Materials Science and Engineering***  
***– New methods for synthesis and processing***

The Swedish Foundation for Strategic Research announces SEK 300 million in a national call for proposals for problem- or application-driven research projects that meet the highest international scientific standards. The call aims to stimulate collaborative interdisciplinary research within the area of Materials Science and Engineering, of relevance to present or future Swedish-based industry and to society.

Selected projects will be supported by grants of SEK 4-7 million per year for a period of 5 years (incl. overheads) to be used for salaries (senior researchers, postdocs, PhD students, etc.), research tools, and running costs according to the operation of the project. Funding for the last two years will be contingent upon a successful midterm evaluation.

### **Background**

Materials science and engineering (MS&E) deals with the discovery and design of new materials, incorporating elements of physics, chemistry, nanoscience and nanotechnology. MS&E is considered as an enabler for the growth of other scientific areas - aggregating its strategic value. The development of new technologies is often limited by material properties in combination with the availability of materials. Therefore the development of new materials with new properties or new processes/synthesis of materials often lead to technological leaps, and may therefore underpin disruptive innovation. Materials synthesis and processing affect a material's microstructure and hence its functional properties. Continued technological progress demands increasingly high-performance materials, materials with special or extreme property profiles, and complex functionality. Swedish material-based industry is dependent on strategic relevant research for its continued competitiveness. Swedish universities and research institutes have an important function both as a supplier of highly educated people as well as producers of high quality science.

### **Scope**

The development of synthesis processes for new and improved materials is considered strategically important for both research and the development of applications. The present call is aiming for supporting research that strengthens Sweden's competitive

power based on excellence and innovation in the areas of synthesis of materials with related processing. The focus of the call is on new synthesis methods and advanced processes control for the formation and production of functional and structural materials. Aspects on structure and properties of the materials should be integrated in the projects, but not be a dominant part, in accordance with the fundamental paradigm of materials science and engineering, i.e. the development of well-balanced synthesis-structure-property-processing-performance relationships.

The call is addressed to research teams with potential to lead innovative research and development in materials synthesis and production within the areas of, for example: energy, machining, machine components, construction, and buildings. This applies to both structural and functional materials.

## **Prioritized research areas**

### *Sintering*

Sintering is the process in which objects are created from powders or compacted green bodies/materials using the mechanism of atomic diffusion. Sintering is an industrial technique of great importance for optimizing the capabilities of different materials. Sintering techniques are used for producing metals, glasses, ceramics, and polymers, and the applications span from, for example, automotive and power industries to electronics.

### *3D-printing/additive manufacturing*

The process of making three dimensional solid objects from a digital file has opened a door for building objects layer by layer out of metals, ceramics or polymers. Components can be designed so that the use of scarce raw materials can be minimized. Applications can be sensors, electromechanical systems, prosthetics, transplants, etc.

### *Wet-chemical, colloid-, and pigmentation techniques*

Wet chemical synthesis combines elements or complex ions through reactions in solution. Wet chemical methods include production techniques for many different materials, and can be used in for example nanoparticle production, synthesis of polymers, fabrication of metal oxides, electrochemical deposition, synthesis of graphene etc. Colloids are one domain of wet chemical techniques of interest for tailored synthesis of new materials. Colloids and pigmentation techniques are of great interest to many industries, e.g., the adhesive, pharmaceutical, and paint industry.

### *Process and synthesis techniques for producing composites, polymers, nanocomposites, and hybrid materials*

Synthesis and controlled mixing of materials at different scale from macro to atomic levels in different proportions give the opportunity to create new materials. These materials cover a very wide scope of applications with the advantage of having tuneable properties, which will be of great importance to meet with the demands for materials with extreme properties or multiple functionalities. For some of these materials, it will be a challenge to improve recyclability.

### *Techniques for processing of Glasses and Cements*

Glasses are solids that possess a non-crystalline atomic-scale structure and could for example be metallic alloys, ionic melts, molecular liquids or polymers. Examples of cements are Portland cement blends, bone cements and dental cements. Applications can for example be orthopaedic/biomedical components, magnetic sensing, electronic components, optical fibres, concrete, etc.

### *Vapour-based deposition techniques*

Deposition techniques are of great importance in many applications such as electronics, optical coatings, protection of substrate materials against for example oxidation and wear etc. Examples of deposition techniques are PVD, CVD and ALD including precursor chemistry, ion/plasma-assistance, or hybrids thereof.

### *Crystal growth from vapour or liquids*

This sub-area concerns crystal growth for production. Important elements are for the process monitoring and quality control, crystal seeding, nucleation and growth, epitaxy, in-situ doping and segregation control. Crystal production may be used for semiconductors (as for wafers), 2D-crystals (graphene), metal alloys (as for turbine blades), chemical compounds (as for pharmaceuticals), polymers, etc.

### *Casting processes*

The knowledge and control of the behaviour of metals in processes such as melting and solidification, and the impact of material compositions on defect formation has a great impact on production development.

The proposed projects should have an emphasis on sustainability. To increase the sustainability in a life cycle of a product many aspect has to be taken into consideration. Efficient use of precursors and raw materials has the potential to minimize waste as well as limiting the impact on the environment. Sustainability will also demand efforts in the substitution of non-renewable critical materials for renewable materials with reduced negative impact on the environment. Minimizing the use of energy both in the processing stage of a material and during the operation or consumption of the product itself is another important aspect. Recycling of materials both at the processing stage, and in the end product, introducing the aspect of a circular economy, where cycles of use and reuse aided by the design of the new materials are used to counteract the linear take-make-dispose economy.

Theory, modelling and experimentation should be integrated in all proposed projects. New, innovative ideas are welcomed, but applicants must also consider the prospects for upscaling to industrial applications. An understanding on all relevant levels of magnitude is needed, from the atomic/nano-level up to the formation and cohesion of the material.

Involvement of industry in the formulation of research questions and participation by industry in the project is considered valuable as it strengthens the strategic element of the research.

## **Eligibility**

All projects should be based on a credible collaboration between, typically, two to four applicants with different kinds of relevant complementary scientific expertise, from one or different research group(s) - not necessarily co-localised. All applicants should take active part in the project and their activities should be at least partly financed by the project budget.

The proposal must be submitted by a main applicant, who is a prominent researcher prepared to assume responsibility for the project during the entire grant period. The applicant must be employed by a Swedish university, University College, university hospital, or by a public or private non-profit research institute. At least one of the applicants must be employed by a university or university college.

Project participation from industry, public authorities or other relevant organisations will be considered a merit. However, such participants must not be funded by the SSF grant

but may participate on their own budget. The same goes for international scientists working outside Sweden unless the project plan itself includes, e.g., visits by foreign-based scientists to an applicant working in Sweden.

The project budget should be in the interval of SEK 4 to 7 million per year for five years. A maximum of 25% 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 25% of the salary of each applicant.

Please note:

- each applicant is allowed to be represented in one application as a main applicant.
- each applicant is allowed to be represented in one application as a co-applicant.

Applications not conforming to these conditions will not be considered. It is the responsibility of the main applicant to inform all the co-applicants and to check the proposal for compliance with the rules before submission.

### **Proposal and submission**

A complete application must contain, among other data specified in the portal, a full description of the research plan and full details of the relevant expertise of the participating groups. It should contain a clear account of the strategic significance of the research, including a vision of utilisation/exploitation of the results in Sweden during the project's lifetime and up to 10 years after completion of the project.

Each proposal shall clearly describe the state of the art within the area(s) addressed. It is also important for the proposal to give a clear picture of the resources available and to demonstrate that the proposed constellation of research groups will be effective in view of its objectives.

A Letter of Intent from the Head of the main applicant's department is compulsory.

The proposal must be written in English and submitted via the SSF portal at: <http://apply.stratresearch.se> **Note that in order to get a complete view of all data required for submission it is necessary to consult the portal.** Please log on to the portal well in advance of the deadline. Please also submit the application in due time before the deadline. When the application is submitted, the system will reject it if some data field is missing. As long as this is done before the application deadline it is possible to submit and re-submit as many times as necessary.

All applications must be submitted by **14:00 hours (2:00 pm CET) on September 24, 2015**. No additional material will be considered after this deadline.

### **Evaluation**

Applications will be assessed by an evaluation committee consisting of generalists and specialists from industry, academia and research institutes. In a first selection the applications will be judged primarily with regard to compliance with the call (as described above), relevance, and impact. Furthermore, applications that are judged unable to compete in the final step of the evaluation, or that are considered too incomplete to be meaningfully assessed, will not pass this first step. The selected applications will be sent on international peer review. The results of this expert review will be taken into account by the evaluation committee in order to produce a recommendation on which SSF will base its decision.

The applications will be reviewed using the following criteria:

- Conformity to the scope and eligibility as outlined above
- Scientific quality; originality, strengths, weaknesses, degree of interdisciplinarity and feasibility of the research plan
- Strategic relevance and impact of the proposed research for Swedish industry and/or society
- Qualifications of the applicants, previous scientific achievements, international experience, and networks, and leadership/management of research teams.

#### **Timetable**

- Last date for applications: September 24, 2015, 14:00 CET at the latest
- Decision by the SSF Board: Spring 2016
- Project start: Spring 2016

No additional material submitted after deadline will be considered.

Please note that the Foundation is subject to the Principle of Public Access to Official Records (Offentlighetsprincipen). Thus, applicants should avoid submitting material that they do not wish to be made public, e.g. information that could prevent patenting.

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