Deutsche Forschungsgemeinschaft (German Research Foundation)
Information for Researchers

Call for Proposals

No. 48 **10 June 2024**

Priority Programme "DaMic – Data-driven alloy and microstructure design of sustainable structural metals" (SPP 2489)

In March 2024, the Senate of the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) established the Priority Programme "DaMic – Data-driven alloy and microstructure design of sustainable structural metals" (SPP 2489). The programme is designed to run for six years. The present call invites proposals for the first three-year funding period.

Production and processing of metallic materials currently account for 40% of all industrial greenhouse gas emissions. The extraction of the associated minerals also produces several billion tons of by-products every year, some of which are harmful. It is therefore imperative that future metallic materials become more sustainable. In the Priority Programme 2489, essential scientific foundations for this development are created and a contribution is made to establish a new field of research at the interface of digitisation and sustainability.

The aim of DaMic is to develop digital methods for inverse materials design and to use them to create new, sustainable and recycling-adapted structural metals. Alloys with a reduced number of elements, in particular critical elements, and thus better compatibility, so-called lean alloys, and material systems with a high tolerance to impurities from the use of secondary raw materials in the sense of the science of dirty alloys are of particular relevance for improving recyclability and sustainability. Possible negative effects of the modified alloy compositions are to be minimised through targeted alloy, microstructure and process design so that the resulting properties are comparable with currently available construction materials.

The projects clustered in DaMic will conduct coherent research into the development and application of data-driven methods for exploration and materials design. Inverse design approaches based on digital Process-Structure-Property (PSP) linkages are to be applied. In view of the complexity and the interacting influences on the mechanical properties, the combination of experiment and simulation in particular opens up the possibility to identify suitable constellations with regard to alloy composition, process parameters, microstructure and properties. In the first funding period, the foundations of the prediction and inversion of the PSP linkages for digital materials design will be created. The second funding period will then focus on the development of end-to-end, fully automated workflows for the quantitative alloy and microstructure design of sustainable metallic structural materials.

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In order to ensure the coherence of the Priority Programme, the focus is on steel and aluminium materials. Only tandem projects in which experts from mechanics and materials science work together are to be funded. The microstructure is an integrating factor within the tandem projects. While the materials science side of the project looks at the alloy- and process-dependent formation and evolution of the microstructure, the mechanics side focuses on the microstructure and analyses its influence on the mechanical properties. This general structure of the projects is to be adapted to the individual expertise of the applicants with regard to numerical simulation and experimental characterisation.

Project proposals are expected to address the following aspects:

- direct improvement of the recyclability and sustainability of steel or aluminium materials through data-driven design and presentation of the expected sustainability improvement;
- establishment of PSP linkages on the basis of experimental data and/or physics-based models or combinations thereof as well as their representation and analysis using data-based surrogate models;
- development of automated inverse design approaches and application to at least one aspect of the PSP linkages, e.g. interaction of composition, process and microstructure or microstructure and effective properties;
- further development and application of experimental and numerical high-throughput methods for capturing the microstructure and its evolution as well as for property prediction;
- active contribution to cross-project data acquisition and analysis

The following topics are not eligible for funding:

- approaches to improve material properties without a design strategy;
- materials design with the aim of an indirect sustainability improvement, e.g. CO_2 savings in operation through lightweight construction;
- development of energy-efficient processes for the extraction of minerals and primary synthesis as well as processes for scrap sorting and post-treatment;
- purely experimental approaches;
- pure correlation analyses and applications of Machine Learning (ML) algorithms;
- development of ML algorithms or data management strategies without direct reference to materials design

Interested researchers are invited to participate in a preparatory meeting to network potential sub-projects. The one-day meeting will take place on 2 October 2024 at Frankfurt Airport. To participate, please register with the spokesperson of the Priority Programme (contact under "Further information") by 30 August 2024. A one-page project summary including the names of the applicants and a brief description of the project is required for registration. The presentation of the respective project ideas during the meeting is mandatory.

Proposals must be written in English and submitted to the DFG by **18 November 2024**. Please note that proposals can only be submitted via elan, the DFG's electronic proposal processing system. To enter a new project within the existing Priority Programme, go to Proposal Submission – New Project/Draft Proposal – Priority Programmes and select SPP 2489 from the current list of calls.

In preparing your proposal, please review the programme guidelines (DFG form 50.05, section B) and follow the proposal preparation instructions (DFG form 54.01, see links below).

Applicants must be registered in elan prior to submitting a proposal to the DFG. If you have not yet registered, please note that you must do so by **11 November 2024** to submit a proposal under this call. Note that you will be asked to select the appropriate Priority Programme call during both the registration and the proposal process.

The DFG strongly welcomes proposals from researchers of all genders and sexual identities, from different ethnic, cultural, religious, ideological or social backgrounds, from different career stages, types of universities and research institutions, and with disabilities or chronic illness. With regard to the subject-specific focus of this call, the DFG encourages female researchers in particular to submit proposals.

The review colloquium for the Priority Programme is planned for February 2025.

Further Information

The elan system can be accessed at:
https://elan.dfg.de/en

DFG forms 50.05 and 54.01 can be downloaded at:
www.dfg.de/formulare/50_05
www.dfg.de/formulare/54_01

For scientific enquiries please contact the Priority Programme coordinator:
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Questions on the DFG proposal process can be directed to:
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