The Dep. of Functional Materials headed by Prof. O. Gutfleisch at the Institute of Material Science at TU Darmstadt is offering a

Doctoral Researcher (PhD) Position: Magnetocaloric $La(Fe,Si)_{13}$-Materials for Next-Generation Energy-Efficient Cooling Technologies

75 % with a fixed-term contract of 3 years.

The position is embedded in the EIT Raw Materials project *"SMARTer" (Sustainable Magnetic Materials for Advanced Refrigeration Technology)*, in which TU Darmstadt, the start-up company Magnotherm Solutions GmbH, the Fraunhofer Research Institution for Materials Recycling and Resource Strategies IWKS, and the Université de Bordeaux are involved. The project aims to optimize magnetocaloric $La(Fe,Si)_{13}$-based compounds, enable their scale-up from laboratory to production level, and manufacture them with optimized geometries as heat exchangers so that they can be implemented and tested in real cooling devices.

Magnetocaloric materials are attracting great attention for their use in solid-state cooling, which represents a more energy-efficient and environmentally friendly technology compared to the vapor-compression technology currently in use. Research into more energy-efficient cooling technologies is crucial, since cooling applications account for around 20% of global electricity demand and 8% of greenhouse gas emissions, with demand steadily increasing worldwide.

The advertised position is based in the internationally renowned Functional Materials Research Group, which specializes in the development of resource-efficient functional materials. In our research, we investigate various magnetocaloric materials regarding their caloric performance and secondary functionalities such as mechanical stability, cyclic behavior, criticality, and non-toxicity. In addition, we use diverse processing techniques to tailor the microstructure of the materials and to construct geometrically complex magnetocaloric regenerators with optimized heat exchange properties. Our research contributes to the development of magnetocaloric materials, ranging from the understanding of fundamental mechanisms to real-world applications. Further research topics of our group include permanent magnets, additive manufacturing of functional materials, and magnetic materials for biomedical and catalytic applications, with a focus on synthesis, characterization, and modeling of magnetic, thermal, and (micro)structural properties.

Your tasks within the project will include the synthesis, optimization, and chemical, magnetic, caloric, and (micro)structural characterization of magnetocaloric $La(Fe,Si)_{13}$-based compounds. Your main goal will be to tailor phase compositions and microstructures during sample synthesis using arc- and induction-melting as well as heat treatments, in order to optimize the caloric effect and secondary properties. You will support this optimization by applying machine learning algorithms. Throughout the project, you will work closely with our project partners. The results will be presented in international journals and conferences as well as in regular project meetings.

Your profile should include an excellent academic degree (Master's or equivalent) in Materials Science, Physics, or Chemistry. Preferably, you have experience with the synthesis and characterization of metallic or magnetic materials. Very good written and spoken English skills as well as outstanding communication skills are essential. German language skills are desirable but not mandatory. We expect you to integrate into our interdisciplinary team and to contribute actively to the overall progress of the project in close collaboration with our partners. Furthermore, you should demonstrate a high level of motivation and independence in pursuing your doctoral research. A strong motivation to publish your results and to present them at international project meetings and

conferences is expected, as well as enthusiasm for working in interdisciplinary and international teams.

We offer the possibility of earning a doctorate in a pioneering research topic in the field of functional materials for caloric cooling and energy conversion, excellent working conditions in an international team, and integration into a scientific network of renowned experts in magnetic materials. The Technical University of Darmstadt provides a varied and diverse working environment, opportunities for independent work, needs-based training opportunities, and individual professional development. Flexible working hours, occupational health management, and the compatibility of family and career are standard. In addition, you will receive free travel authorization for local and regional public transport within the state of Hesse (LandesTicket Hessen) according to the applicable regulations. All university employees may also take advantage of the salary conversion option for a "JobRad" (company bike leasing) model.

TU Darmstadt is committed to increasing the proportion of female staff and therefore strongly encourages women to apply. Applicants with disabilities of at least 50% will be given preference if equally qualified. The salary will be based on the collective agreement for the Technical University of Darmstadt (TV - TU Darmstadt). Part-time employment is generally possible.

Applications should be submitted as a single PDF file including the usual documents, quoting the reference number, by e-mail to info@fm.tu-darmstadt.de and addressed to the contact persons listed below. For questions, please contact Dr. Benedikt Beckmann (benedikt.beckmann@tu-darmstadt.de) or Prof. Oliver Gutfleisch (oliver.gutfleisch@tu-darmstadt.de). Further information about the research group can be found at https://www.mawi.tu-darmstadt.de/fm.