

# PRESS RELEASE

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PRESS RELEASE  
June 18, 2024 ||

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## Ensuring a Resilient and Sustainable Supply of Functionally Reliable Materials: Fraunhofer Develops Digital Ecosystem and Rapid Screening Methods

Due to crises such as the coronavirus pandemic or suspended trade agreements, supply bottlenecks occur time and again. Raw materials such as nickel, magnesium and rare earths, which industry needs to manufacture a wide range of products, are not always available — often for long periods of time. This is where a new Fraunhofer-Gesellschaft flagship project comes in: Since January 2024, six Fraunhofer Institutes have been researching how sustainable and resilient supplies can be maintained and secured. The four-year interdisciplinary project aims to create the information basis for preserving materials and components in the highest possible quality and feeding them into the cycle.

“Preserving our prosperity in the face of finite resources is and remains a central issue for our society,” says Prof. Peter Gumbsch, director of the Fraunhofer Institute for Mechanics of Materials IWM. “The ability to manufacture sustainable products plays a key role in this. The basis for this are modern materials that are not only available as raw materials, but must also be recycled in a high-quality form.” This is the aim of the new Fraunhofer flagship project “ORCHESTER,” in which six Fraunhofer Institutes are working together along the value chain. Accompanied by a high-ranking advisory board from research and industry, the experts from the participating institutes want to jointly create an innovative initiative that addresses the challenges of the circular economy and supply security — especially in the context of the transformation of the energy system.

### Secure material supply for the future

The new flagship project is an important step in the development of a sustainable material supply — a blueprint for overcoming crises. “We don't know what challenges will affect us in the future, so we need tools to be able to react quickly and appropriately,” explains Dr. Dirk Helm, who heads the Manufacturing Processes business unit at Fraunhofer IWM. “With innovative approaches and interdisciplinary collaboration, we will be able to better manage these crises.”

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The project aims to expand the range of materials that can be used, increase the proportion of recycled materials in processes and reduce the use of rare earths from the primary source. The overall objective is to achieve a paradigm shift in material specification away from a definition based on material composition towards a function-based specification, for faster substitution of critical materials and thus a more resilient material supply.

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**Three demonstrators illustrate the effectiveness of “ORCHESTER”**

The project showcases its effectiveness through three demonstrators that focus on material specification, recycling and criticality: For example, for bipolar plates for electrolyzers and fuel cells or heat exchangers, whose costs are largely determined by the nickel content — a critical element with a high supply risk — methods are being researched to reduce this proportion without impairing the essential functional properties of the bipolar plates. Another concern the project team plans to address relates to maximizing the secondary material content of the aluminium alloy in compressor wheels for hydrogen pipelines, fuel cells and heat pumps in order to minimize the energy footprint. The project relies on experimental and simulation-based high-throughput screening methods to identify efficient alloy variations.

The third demonstrator focuses on the recycling of permanent magnets for electric motors and wind turbines; simulation models and machine learning are used to predict the influence of impurities on magnetic performance and determine corresponding alloy windows. “These demonstrators are not only technological masterpieces, but also important steps towards a more sustainable and future-proof material supply,” says Dirk Helm. “They show that our research results can be applied in practice and offer real added value for industry.”

“ORCHESTER” is not only a pioneering research project, but also an important step towards a reliable and forward-thinking material supply for the energy transformation. “The added value is manifold,” explains Dirk Helm. “This includes an improved selection of applicable materials, an increase in the proportion of recycling in process routes, a shorter development time for alloys, fewer rare earths from the primary production process and increased resilience.” The project illustrates how digital innovations can contribute to overcoming the challenges of a sustainable and resilient supply of functionally reliable materials. By combining research, technology and collaboration, “ORCHESTER” sets new standards for the future of industrial production and contributes significantly to the realization of a sustainable and future-proof economy.

The project consortium is coordinated by Fraunhofer IWM and consists of: Fraunhofer IWM, Fraunhofer IWU, Fraunhofer IWS, Fraunhofer ISI, Fraunhofer IWKS, Fraunhofer IZFP.

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For a holistic evaluation of the manufacturing process and material function as well as sustainability and resilience; from raw material extraction, continuous casting, rolling and forming to the production, use and recycling of components — the new Fraunhofer flagship project “ORCHETSER.”