ORCHESTER

Digital ecosystem for a resilient and sustainable supply of functionally reliable materials

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A Fraunhofer Flagship Project



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Global Challenges and Regulatory Drivers



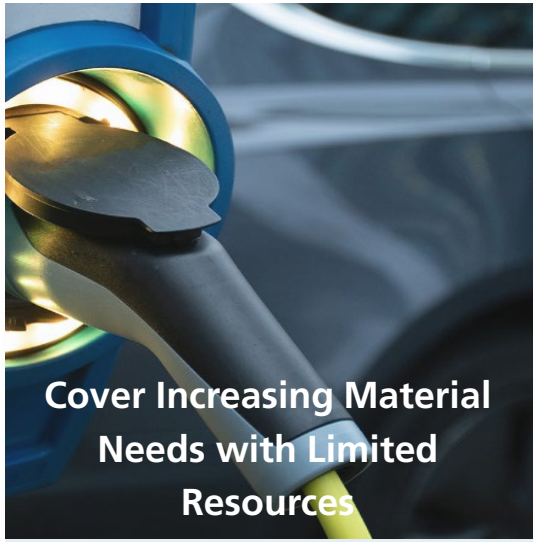
Ensuring Human Rights & Environmental Standards in Supply Chains

EU Corporate Sustainability Due Diligence Directive since 25.07.2024



Manage Volatile Material Flows Due to Geopolitical Uncertainties

German National Circular Economy Strategy



Cover Increasing Material Needs with Limited Resources

Critical Raw Materials Act (Targeting Reduction of Dependencies by 2030)



Become the First Climate-Neutral Continent with Green Processes & Products

European Green Deal (Climate Protection Targets for 2030 and 2050)

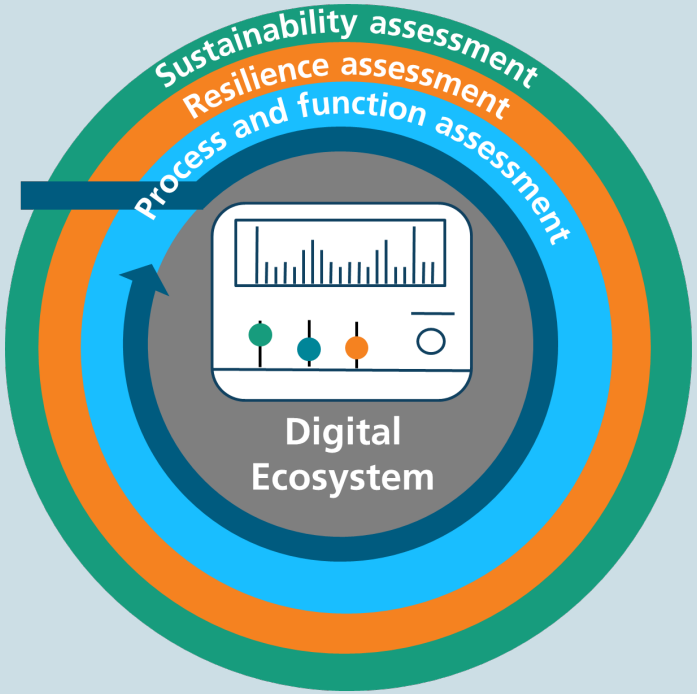
Approach to secure material supply

ORCHESTER enables holistic assessability and measurable improvements

Driver
Material availability
Change in corporate philosophy
Politische & and economic crises
Legal requirements
Climate change
Costs
Function

ORCHESTER: Solution Approach and Benefits

Holistic assessment of the manufacturing process, the material function, sustainability, and resilience.



Range of applicable materials	5x
Recycled content in process routes	+50%
Development time for alloys	-50%
Rare earths from primary production	-25%
Increase in resilience	+30%

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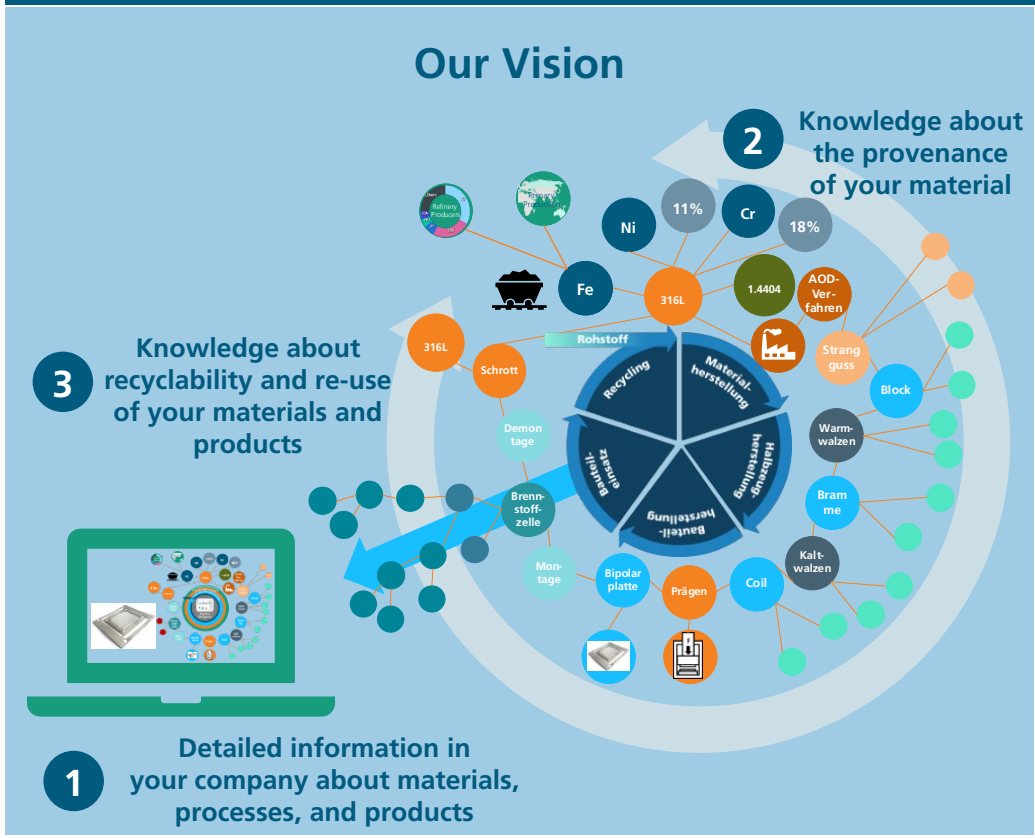
Approach to secure material supply

ORCHESTER enables holistic assessability and measurable improvements

Driver

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- Change in corporate philosophy
- Politische & and economic crises
- Legal requirements
- Climate change
- Costs
- Function

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Solution approach for a secure material supply

Demonstrators in the context of the energy transition

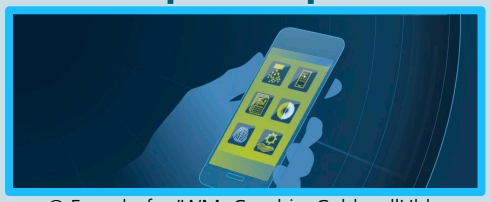
Demonstration and benchmark using examples of the energy transition		
Bipolar Plates for Electrolysers & Fuel cells **Focus: Material selection and specification**	**Compressor Wheels** for hydrogen pipelines, fuel cells & heat pumps **Focus: Recycling**	**Permanent magnets** for electric motors and wind turbines **Focus: Criticality**
Material and its core challenges		
Stainless steels with a high Ni content: Availability of nickel in crises and raw material costs (Ni is 50x more expensive than Fe)	**Al alloys:** Impurities in the secondary material content problematic	**Rare earth magnet material:** Dependencies especially on China, not an established secondary cycle
Increasing sustainability and resilience		
Wider specification windows allow larger material selectionsl	Mastery of **impurities** allows higher **secondary material content**	Intelligent **sorting** and **substitution** allow use of **waste magnets**

Solution approach: Digital products

New possibilities with tailor-made digital products

Requirements

Develop data products



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Structuring data



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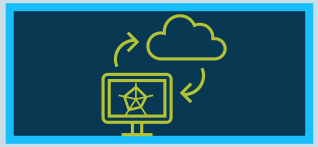
Implement data streams



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Digital Products: Ensuring Function, Resilience & Sustainability

- Digitally supported **recommendations** for action or **decision-making** aids based on data and AI
- **Data exploration** along the entire value chain enables optimal function, resilience and sustainability
- **Early warning system** for material flow, material availability, criticality and raw material footprint enable proactive action



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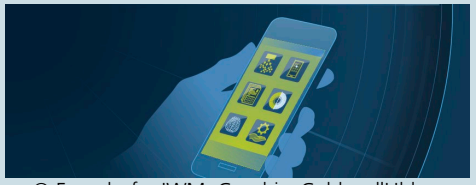
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Solution approach: Building the digital ecosystem ORCHESTER

Platform for data and digital products

Requirements

Develop data products



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Structuring data



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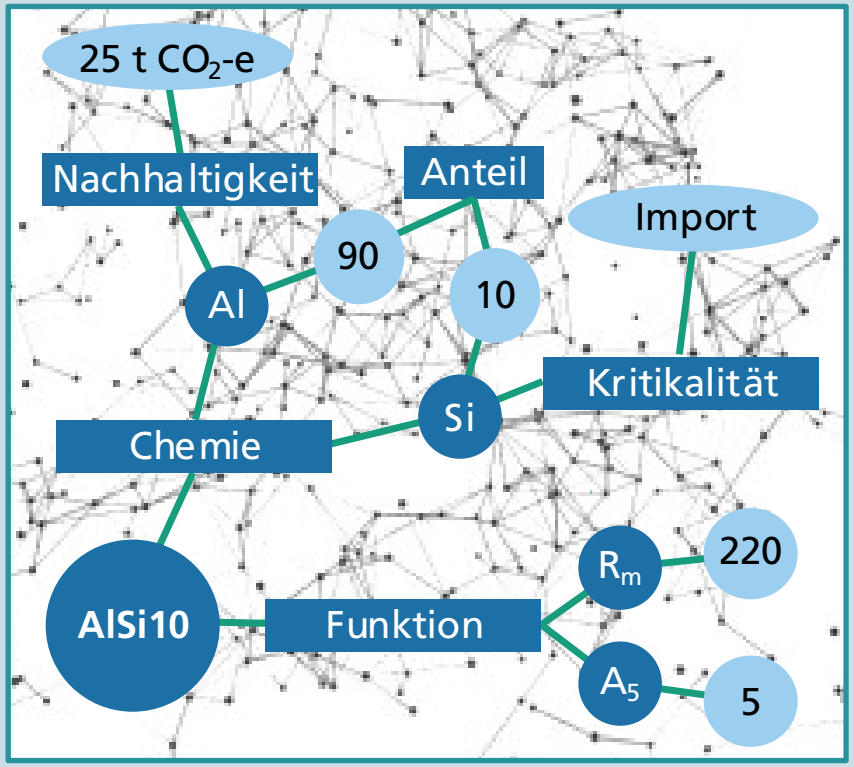
Data model

- Standardization of data description via ontology-based data models

Added value: FAIR data, unified data processing

Dataspace & Knowledge Graph

- Integration of disparate data into one data room
- Fused data from different sources
- **Added value:** Explorable & AI-enabled data



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Contacts



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