»Advanced Materials«

Enabler for new Innovations

"Around 70 percent of all new products are based on new materials and processes."

Prof. Hartwig Höcker
RWTH Aachen University

"The technical progress in key fields depends on successful material developments."

Dr. Peter Schepp
Senior Experten Service (SES)

Start: May 2018
End: April 2019
Costs: € 25,000

Join the consortium to …

discover new Advanced Materials and their **potential impact** on exciting new products:

- Receive a structured overview of both **mature** and **new, innovative** materials like nanomaterials, smart materials, composites, alloys and many more
- Get **detailed material studies** including the assessment of **processability** and **development potential for selected materials**
- Learn about potential **applications** and benefit from **roadmaps** for advanced materials
- **Network** with key players and technology experts along the value chain in order to learn about current **needs** and focused cross-industrial **applications**

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Deutsches Zentrum für Luft- und Raumfahrt (DLR)

Fraunhofer IPT

WZL | RWTH AACHEN UNIVERSITY

Motivation

Initial Situation

In the past, specific materials shaped an entire epoch like the “Bronze Age”, the “Iron Age” or the “Plastic Age”. Today it is a plurality of new, innovative and individual adapted materials that dominate the technical development.
Nowadays, it seems that there is hardly anything that characterizes society as much as technology, and hardly anything that characterizes technology as much as materials.

Frequently asked questions of companies are:

- What kind of new properties can be achieved with Advanced Materials?
- Which applications can profit from the new material properties?
- Which functionalities can be integrated in the future?

Major Outcome for Participants

- → **A structured and detailed overview of upcoming trends and latest developments in the field of advanced materials**
- → **Get a basis for decision-making for current materials and future material highlights**
- → **Access to a large cross-industrial & interdisciplinary partner network of users and material manufacturers**

Procedure

- Identification of current developments and forecasts in the field of Advanced Materials
- Consolidation of the generated results within user-oriented innovation patterns and tools for the support of management decisions
- Detailed Investigations for selected materials and applications resulting in a roadmap for these materials

Key Questions

User

What kind of new material properties are to be expected?

Which new applications and functions can be realized with new materials?

When does the material enter the market?

What new product features can be realized?

What research facilities are exploring this material?

Which technological maturity does the material have?

What advantages can be generated?

…

What processability developments can be expected?

What are the upcoming material trends?

Material Manufacturer

Which market requirements can be addressed?

Do materials exist that can be produced with the current process chain?

Is there a substitution risk or a new exploitation opportunity?

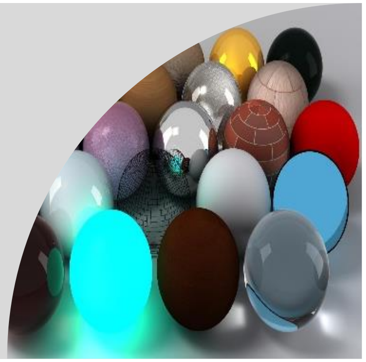
What market impact can be achieved?

…

Advanced Materials Scope

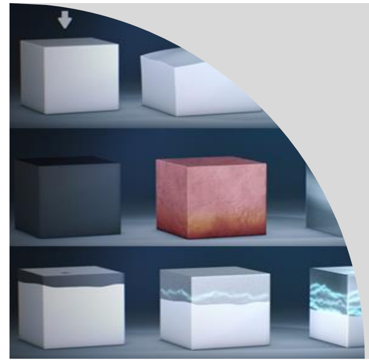
Observation fields

Types



- Polymer
- Metal
- Alloys
- Ceramics
- …

Properties/ functions

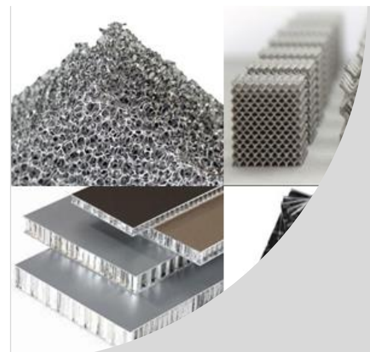


- Lightweight
- Electrical
- Magnetic
- Thermal conductive
- …

Industries

- Automotive
- Medicine
- Aerospace
- Energy
- …

Architecture



- Foam
- Lattice
- Sandwich
- Composite
- …

Scale of engineering

Nanomaterial → Micromaterial → Macromaterial

Material Types
Exemplary Materials

Metal
- High performance alloys
- Foam
- Amorph metals
- …

Polymers
- Electroconductive polymers
- High temperature polymers
- Biocompatible
- …

Ceramics
- Biomorphous ceramics
- Ceramic tapes
- Foam
- …

Biomaterial
- Bio ceramics
- Bio composites
- Bio polymers
- …

Composites
- Ceramic Matrix Composite (CMC)
- Metal Matrix Composite (MMC)
- Polymer Matrix Composite (PMC)
- …

Semiconductors
- Ultra-Wide Bandgap (UWBG) Materials
- …

Smart Materials
- Shape memory alloys
- Self healing materials
- Self adapting materials
- …

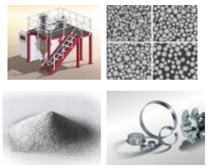
Nanomaterials
- Engineered nanomaterials
- Natural nanomaterials
- …

Liquids
- Ionic liquids
- Electrorheological fluid
- Magnetorheological fluid
- …

Extract of Addressed Markets in This Project

Consortium Structure

Material Manufacturer



- Machine tools
- Process technology
- Tools and fixtures

User

- Representatives of industries affected by advanced materials

Research Institutes

Fraunhofer

RWTH AACHEN UNIVERSITY

DLR Deutsches Zentrum für Luft- und Raumfahrt

Supply Chain

- Research scientist
- Material developer
- Production specialist

Consortium Project

Material Trends

Roadmaps

R&D landscape

Applications trends

Results

Interdisciplinary Consortium

- Minimum 15 consortium partners
- € 25,000 per partner
- 12 month duration
- Worldwide scope
- Kick-off and 2 interim selection meetings
- Final presentation and report

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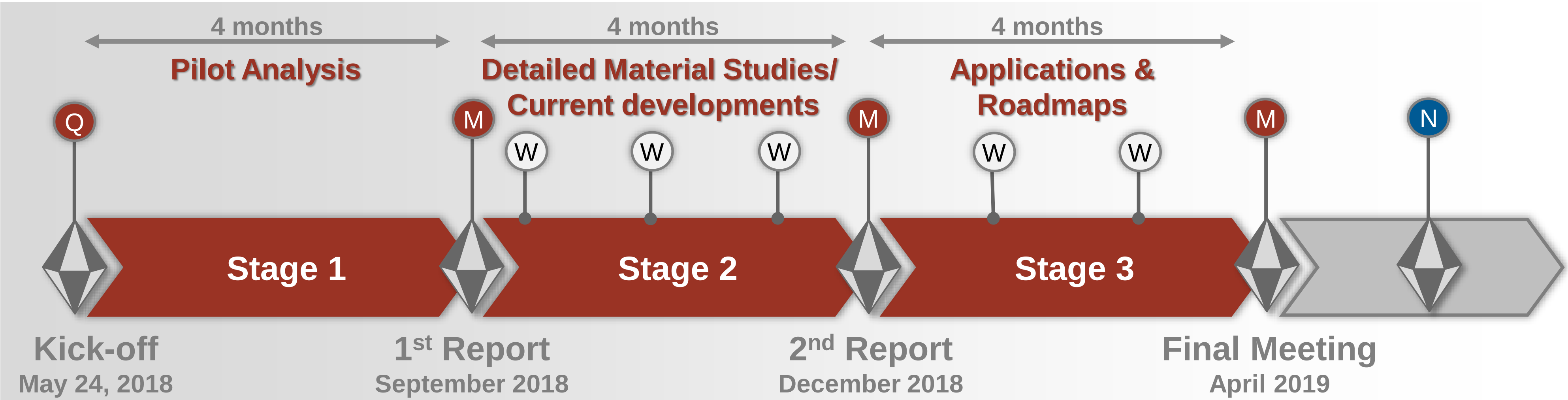
Project Timeline



Stage 1 Content:

- **Segmentation** of material types and functions
- **Scanning & Scouting** for different advanced materials where hidden potentials are expected
- **Pre-evaluation** of materials based on criteria defined by the consortium
- Result: Detailed overview in “material performance trees”

➔ ***Information basis for material selection for <u>Stage 2</u>***

Stage 2 Content:

- Systematic selection of attractive **materials** and specific **questions** by the project partners
- Detailed **material studies** for each selected material and question
- Assessment of **processability and development potential**
- Identification of relevant **research facilities** (science, industry)

➔ ***Information basis for your selection of relevant focus cases in <u>Stage 3</u>***

Stage 3 Content:

- Identification of attractive **applications in different industries** for selected materials
- Evaluation of these applications regarding **advantages, disadvantages** and a **cost analyses** if practicable
- Derivation and development of application-related **roadmaps** for selected materials

➔ ***Information basis for partner-specific roadmaps/decisions***

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W Optional workshops with partners/ experts

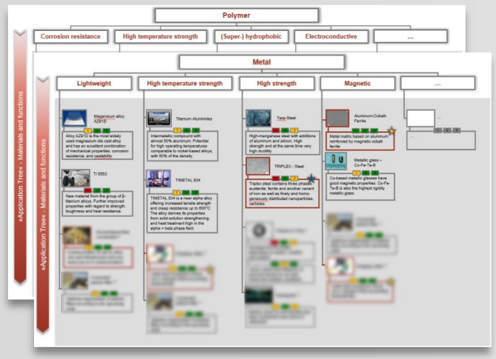
Q Questionnaire

M Consortium meeting

N Optional network meeting with partners of former consortium and ACAM

Expected Results for the Different Stages
Exemplary Outlook

Stage 1



Material performance trees:

- Structured and detailed information about identified materials regarding material type and material functions
- Pre-evaluation for materials based on defined criteria

Stage 2

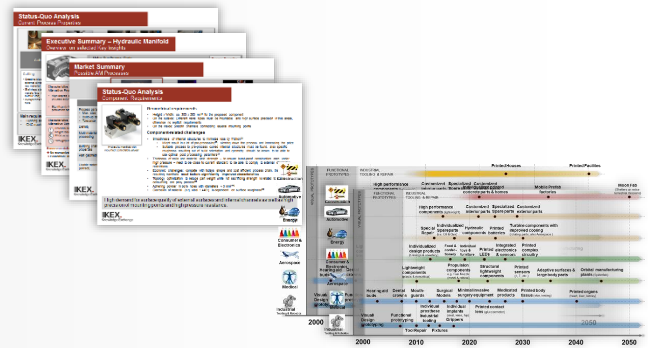
Expert landscape:

- List of relevant research facilities (science, industry)

Material Analyses:

- Detailed information about materials that have been selected after stage 1 from the consortium

Stage 3



Applications:

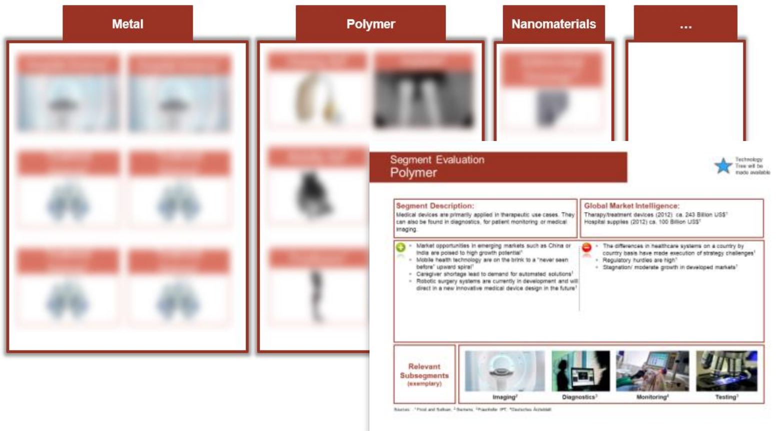
- List and assessment of applications manufactured using the selected materials. Applications of partners are considered

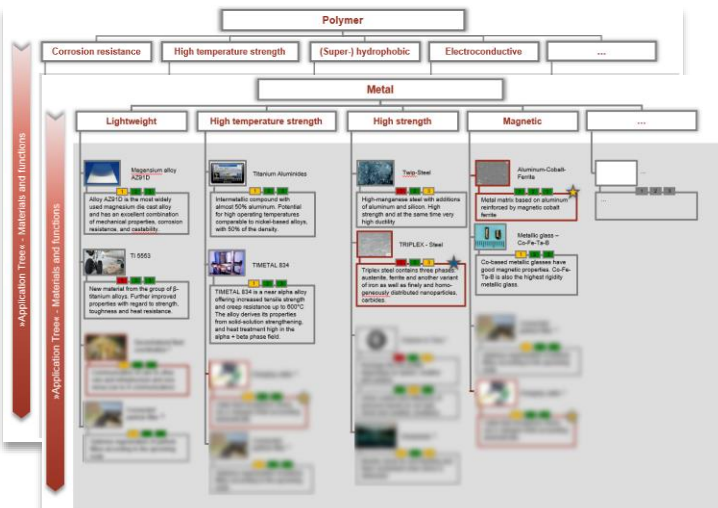
Roadmaps:

- Definition of application-related roadmaps for the selected materials

Proceeding – Exemplary Outlook
Stage 1: Pilot Study

1 2 3
Project Stage





Material Segmentation

- Selection of focus areas based on consortium preferences (questionnaire) and major trends
- Systematic overview on material segments and structure within the focus areas

Detailed Segment Analysis

- Derivation of major challenges within these sub-segments in order to enable a focused selection of growing or currently developing material opportunities

»Material performance Tree«

- A structured and detailed overview of upcoming trends and latest developments in the field of Advanced Materials will be presented in material performance trees to the consortium during the 1st report meeting
- The trees are divided in the segments material types (metal, polymer, etc.) and the sub-segments material functions (lightweight, high temperature, etc.)
- A pre-evaluation of identified materials regarding criteria defined by the consortium (e.g. cost factor, readiness level and innovation potential)

➢ **Information basis for material selection for Stage 2**

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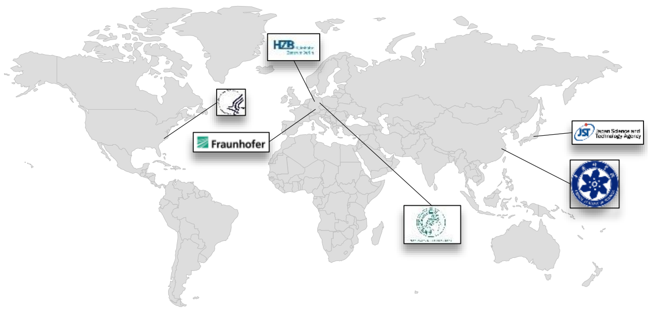
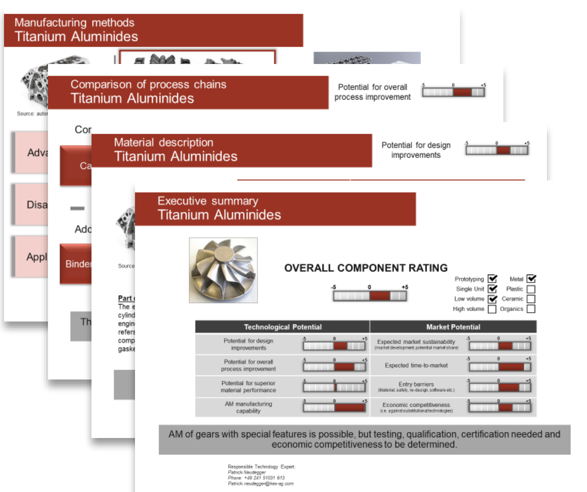
Proceeding – Exemplary Outlook
Stage 2: Detailed Material Studies

1 | **2** | 3
Project Stage





Expert landscape

- Identification of relevant research facilities (science, industry) conducting research and development in the field of the selected materials
- Determination of potential partners

Detailed Material Analyses

- Assessment of processability, development and innovation potential, cost structure and technological readiness level for selected materials
- Current pros and cons of different materials and its development potential in the next years
- Examination whether the properties of the material match the requirements of the industrial environment
- Executive summary for a quick evaluation

➢ **Information basis for selection of relevant focus cases in Stage 3**

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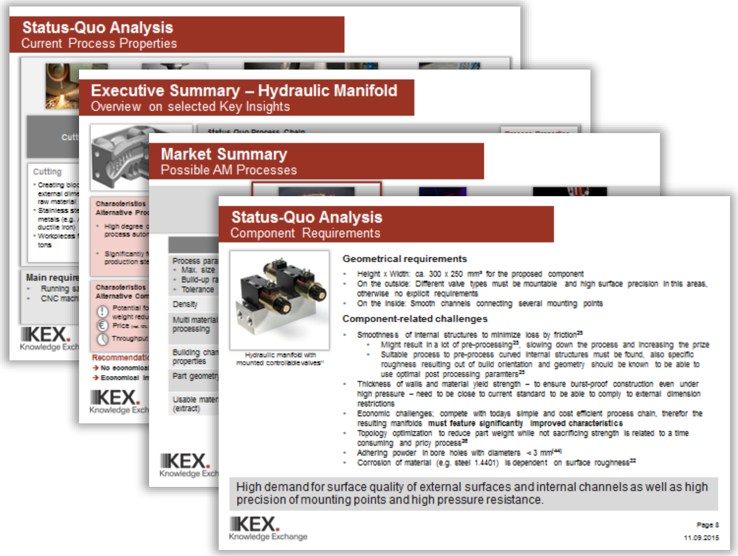
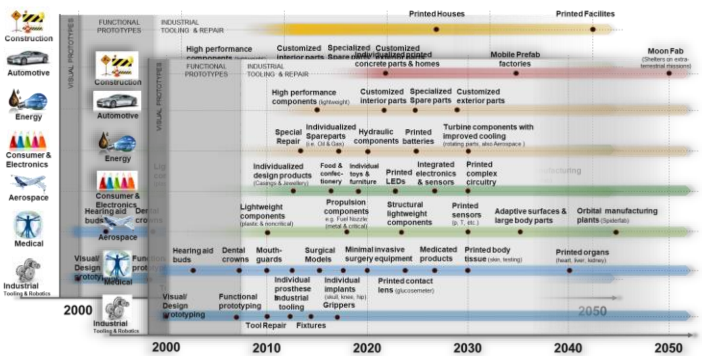
Proceeding – Exemplary Outlook
Stage 3: Applications & Roadmaps

1 2 3
Project Stage





Applications & Roadmaps

- Identification of suitable applications regarding the chosen materials and classification of these applications into the respective industry
- Evaluation of these applications regarding advantages, disadvantages and a cost analyses
- Definition of application and development roadmaps for the selected materials

➢ **Information basis for partner-specific roadmaps/ decisions for internal projects and implementation**

Project References

Consortium Project Framework:

- **Result generation by research partners** (Fraunhofer IPT, ACAM, KEX)
- **Face-to-face results presentation** and **discussion** with industrial consortium partners
- Moderated **cross-industrial workshops** and **expert key note speeches**
- **Networking** with a **cross-industrial consortium** and **highly relevant research entities**

More than 80 previous Consortium *Partners

…
VW
ASM
…
Freuden berg
DSI Laser
HOMAG
3M
ZF Friedrichs -hafen
Hexagon
Altana
DSM
B Braun Aesculap
Erowa
Höganäs
Hyosung PIS R&D Center
Chiron-Werke
Knorr-Bremse
Covestro
Delcam
GEA
Kostal
Hilti
Alstom
Oerlikon Metco

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* all mentioned companies are partners of a **Additive Manufacturing** consortium project hosted by KEX AG and the research partners

A Powerful Team in Technology Research
Institutes and Companies in and beyond Aachen

Campus Melaten
RWTH Aachen University

Expert Network in Aachen:

Fraunhofer IPT
- Founding Year: 1980
- Knowledge and experience in all fields of production technology for developing and optimizing solutions for modern production facilities

WZL RWTH Aachen
- Founding Year: 1906
- Knowledge and experience in all fields of production engineering and production management for developing and optimizing solutions for modern production facilities

KEX Knowledge Exchange AG
- Founding Year: 2012
- Technology and market information provider

Additional Experts:

DLR Institute of Materials Research
- Founding Year: 1967
- Knowledge and experience in development of new material solutions and their processing techniques

Your Contacts

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