

COMET MODULE

REPAIRTECTURE –INNOVATIVE REPAIR CONCEPTS FOR POLYMER-BASED MATERIALS AND COMPONENTS ALONG THEIR LIFE-TIME

Main location: Leoben (Styria)

Other locations: none

Thematic area: Material and Production



Thematic focuses

- Developing new simulation tools for predicting the need for repair
- Modelling and characterizing the reliability, lifetime and performance of repaired polymeric parts
- Synthesis of repairable thermosets and polymer-based composites
- Establishing modular and reliable eco-design concepts for repairable polymer-based components
- Developing new (mechanical and chemical) bonding concepts for easy-to-repair products
- Exploring thermal metamaterials for controlled disassembly of bonded structures
- Consideration of life cycle aspects of repair processes in contrast to recycling and currently applied waste management routes

Planned realisation and outcomes

The COMET Module Repairitecture focuses on innovative simulation, material, design and bonding concepts for a circular economy of polymer-based products and composite structures which retain their functionality, performance and appeal over an extended lifetime. By following an ambitious and highly interdisciplinary research program, Repairitecture aims at the development of new crosslinked polymers (e.g., thermosets) which have the ability to repair damages on a molecular level, reversibly adapt their viscoelastic properties (for repairing macroscopic damages), and change their adhesion performance on demand in order to repair and refurbish bonded multi-material structures. The strategies pursued within Repairitecture lay the foundation for (i) innovative mounting and straightforward disassembling strategies, (ii) new modular design guidelines, (iii) convenient repair/remanufacture processes for structural and functional polymer-based products, and (iv) savings of costs and resources.

Repairitecture's research program will go beyond established recycling routines for polymer products, and will induce a scientific and technological step-change in repairable and refurbishable polymer components. The unprecedented combination of stimuli-triggered molecular functions with reliable properties and modular architectures is expected to bridge environmental sustainability and economic efficiency with advanced repair/remanufacture processes. Selected examples of highly functional and repairable products in future applications comprise (i) multi-component lighting systems (e.g., automotive), (ii) personalized healthcare products (e.g., orthoses), (iii) bonded structural polymeric composites (aircraft/automotive industry), (iv) ready-to-repair consumer electronics, as well as (v) structural adhesives for debonding on-demand processes.

COMET FACTSHEET

Selected company partners (max. 10):

1. Andritz AG
2. Borealis AG
3. Brose Fahrzeugteile SE & Co. Kommanditgesellschaft, Bamberg
4. Eologix Sensor Technology GmbH
5. FACC Operations GmbH
6. Luxinergy GmbH
7. Mitsui Chemicals Europe GmbH
8. Roartis bvba
9. ZKW Lichtsysteme GmbH

Selected scientific partners (max. 5):

1. Graz University of Technology (Institute for Chemistry and Technology of Materials)
2. Johannes Kepler Universität Linz (Institute of Polymer Product Engineering)
3. Montanuniversität Leoben (Chair of Chemistry of Polymeric Materials)
4. Montanuniversität Leoben (Chair of Materials Science and Testing of Polymers)
5. University of New South Wales (School of Chemical Engineering)

Selected international¹ partners (max. 5):

1. Brose Fahrzeugteile SE & Co. Kommanditgesellschaft, Bamberg
2. Czech Academy of Sciences (Institute of Physics of Materials)
3. Leibniz-Institut für Verbundwerkstoffe GmbH
4. Maastricht University (Aachen Maastricht Institute for Biobased Materials)
5. Mitsui Chemicals Europe GmbH

Duration: 01.01.2024 - 31.12.2027 (4 years)

Staff employment: 8 FTE, thereof 30 scientists

Management: Priv.-Doz. Dr. Sandra Schlögl, Executive Manager of the Modul
Dr. Elisabeth Ladstätter, CEO
Univ.-Prof. Dr. Wolfgang Kern, Scientific Director
Contact: Polymer Competence Center

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Status 29.01.2024

The COMET Module is funded within COMET – Competence Centers for Excellent Technologies – by BMK, BMAW as well as the co-financing federal provinces Styria and Upper Austria. The COMET programme is managed by FFG. www.ffg.at/comet

¹ Partners with headquarters outside Austria