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1 *For many product systems, it is imperative that specific closed recycling management loops be established for the long-term conservation of material resources.*
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2 *Along with the actual manufacturing processes and routes, their various technologies are also decisive for Life Cycle Assessments.*
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COMPETENCES IN DETAIL

MATERIALS AND PRODUCT SYSTEMS

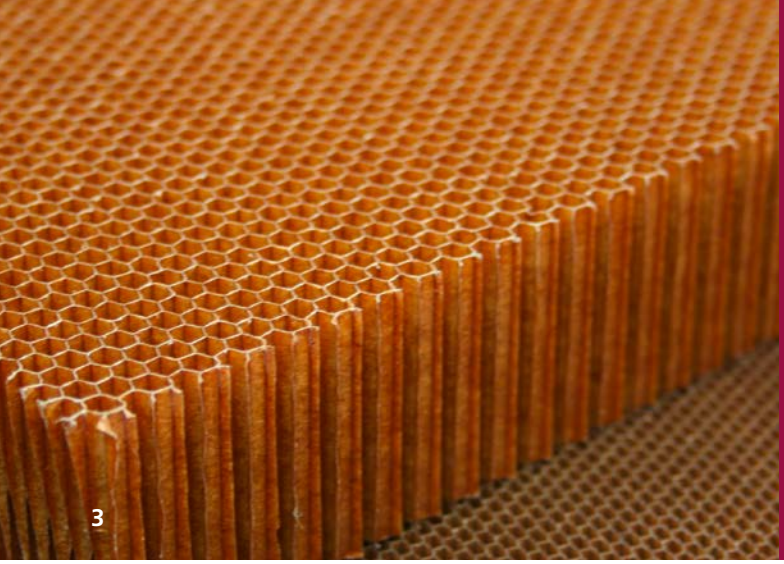
The group Materials and Product Systems at Fraunhofer IBP, Department Life Cycle Engineering, deals with questions considering Life Cycle Assessment (LCA) of primary products, materials and product systems from the production, throughout the utilization and the recycling or disposal at the end of life. Key aspects of the current activities are Life Cycle Assessments in fields such as resource and system efficiency, renewable raw materials, plastics and composites as well as metals. This also includes the development of methods for the integrated analysis of social, economic and ecological aspects.

Chemistry and biotechnology

They provide the basis for a variety of our daily used goods, e.g. materials, food and cosmetics. In the context of production, utilization and disposal of these goods various ecological issues arise. Material comparison from an ecological perspective needs a comprehensive approach covering the entire life cycle. Diverse methods and routes for the production of base chemicals, whether from fossil or biological feedstock, require extensive knowledge of the applied technologies to make statements about their environmental impacts.

Plastics and composites

Plastics and composites are found in almost any fields. Whether in the dashboard of a car, as insulation in buildings or as lightweight components in aviation. Composite materials are gaining importance through the increasing prevalence of lightweight construction in various applications. In addition, biopolymers are in the focus of current research. Considering the entire life cycle is of significant importance to make statements on the entire environmental impacts.



Iron and non-ferrous metals

Despite the rising relevance of plastic and composite materials, metals remain important for industrial applications. For this purpose, accompanying life-cycle evaluations of environmental effects are carried out. This includes ore mining, production and processing as well as recirculation of metals in recycling systems. Rare earths or highly alloyed metals for special applications are also examined for their environmental impacts.

Recycling and recirculation of high-value material flows

The recycling of material flows promises environmental benefits; whether and how large they eventuate is to be determined depending on the specific procedure. Combustion destroys the materials but supplies energy which would otherwise be provided by primary energy carriers. Sequences of separation, decomposition and forming are necessary for the material utilization of waste flows. The energy and material effort of the corresponding procedure must be systematically juxtaposed to the ecological benefit from avoiding the use of primary materials. According to the complexity of the materials to be recycled, different degrees of separation and decomposition are desirable. The method of Life Cycle Assessment is used to quantify trade-offs between different credits for avoided primary raw materials or primary energy carriers.

Renewable raw materials and food

The use of renewable raw materials increasingly raises political and societal interest. In particular, with the fixing of CO_2 in plants, renewable raw materials are considered exceptionally important in the effort to reduce emissions of greenhouse gases: They are regarded as largely CO_2 neutral because at the end of their life they only release that amount of CO_2 which was fixed during their growth. Nevertheless, products from renewable resources are not always estimated to be positive and beneficial. The cultivation and processing of renewable raw materials may lead to significant environmental impacts; however blanket statements on this are difficult. Instead, individual case studies for the ecological assessment of renewable resources are needed.

Methodological development

In addition to the LCA of different materials and product systems, methodological developments are also a core aspect of the group's activities. The focus is on energy costs sensitivity analysis, resource and system efficiency, Land Use and Biodiversity, Life Cycle Costing (LCC) and integrated approaches for assessing environmental, economic and social sustainability.

Our competences

- Life Cycle Assessment of Materials and Product Systems
- Design for Life Cycle: Design support from a Life Cycle Perspective
- System-wide resource efficiency
- Sustainable Production, Consumpton and End-of-Life
- Life Cycle Costing (LCC) and Eco Efficiency Assessment
- Land Use and Biodiversity

3 *High-performance materials ideally unite the aspects of weight reduction, consistent mechanical properties and lower resource consumption.*
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4 *Industrial Land Use and its consequences for ecosystems have not yet been given adequate consideration in Life Cycle Assessments.*
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