Producing hybrid lightweight structures: automated process chain with quality assurance

About this project

NeLiPro

Producing hybrid lightweight structures: automated process chain with quality assurance

Markets:

Material: Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP)

This project is funded by the Technology Transfer Programme Leichtbau (TTP LB) of the Federal Ministry of Economics and Climate Action.

Technology Transfer Program Leichtbau

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Context

Lightweight construction plays an important role in increasing the efficiency of vehicles. It enables a higher payload and offsets the additional weight through electric drives and energy storage. At the same time, it helps to conserve resources - whether through lower material consumption, more efficient production, longer use or better recycling.

Metallic materials such as steel still dominate in vehicle construction, but their high strength is accompanied by considerable weight. Alternative lightweight construction solutions have so far only been used to a limited extent due to high costs or technical hurdles. This is where the NeLiPro project, short for Next Level Lightweight Production, comes in.

Purpose

The researchers are investigating ways to produce hybrid fibre composite components that are lighter and whose highly stressed components can also be manufactured in large quantities in a resource-efficient manner - while at the same time offering a wide range of variants. With a modular system, the range of applications for fibre composite lightweight construction is to be extended to various applications, particularly in commercial vehicles and rail transport. Through energy-efficient manufacturing processes that consume up to 80 per cent less energy and by reducing the weight of the vehicles, the researchers want to significantly reduce CO2 emissions - both in production and during use. Digital methods for process monitoring and quality assurance should also ensure the scalability of production. Furthermore, recycling strategies are to be developed to make lightweight construction economically and ecologically viable in the long term.

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Procedure

The researchers are developing and validating an integrated production chain for lightweight components. A key innovation is the automated production of fibre composite components, which are connected to metallic load introduction structures. New manufacturing and joining processes ensure precise and highly resilient connections of the components, while digital methods for error detection and data management further optimise the process chain. For process-integrated quality assurance, the researchers use, among other things, an inline microwave inspection system that enables the early detection of quality deviations during the production of the fibre composite structure. The researchers integrate recycling strategies at an early stage in order to minimise waste and facilitate recycling. Finally, the scientists are evaluating the environmental sustainability of the new processes and products through a comprehensive life cycle analysis.

Funding duration:

Funding sign:	03LB4004	**Funding amount:**	EUR 2.4 million

Further websites foerderportal.bund.de/foekat/jsp/SucheAction.do?actionMode=view&fkz=03LB4004A - NeLiPro in the federal funding catalogue

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Lightweighting classification

	Realisation
Offer	
Products Parts and components	✓
Services & consulting	
Field of technology	
Design & layout Lightweight manufacturing	✓
Functional integration	
Measuring and testing technology Component and part analysis, Environmental simulation, Materials analysis	✓
Modelling and simulation Loads & stress, Life-cycle analysis, Processes, Materials	✓
Plant construction & automation Plant construction	✓
Recycling technologies Recycling	✓

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Lightweighting classification

	Realisation
Manufacturing process	
Additive manufacturing 3D printing	✓
Coating (surface engineering)	
Fibre composite technology Filament winding, Others (Pultrusion)	✓
Forming Impact extrusion	✓
Joining Adhesive bonding	✓
Material property alteration	
Primary forming Pultrusion	✓
Processing and separating	
Textile technology	
Material	
Biogenic materials	
Cellular materials (foam materials)	
Composites Glass-fiber reinforced plastics (GFRP), Carbon-fiber reinforced plastics (CFRP)	✓
Fibres	
Functional materials	
Metals	
Plastics	
Structural ceramics	
(Technical) textiles	