

Recycling GFRP composites: How to assess environmental performance?

Ulrike Kirschnick¹, Nina Krempf², Ralf Schledjewski¹

¹Processing of Composites group, Department Polymer Engineering and Science, Montanuniversität Leoben, Austria

²Chair of Polymer Processing, Department Polymer Engineering and Science, Montanuniversität Leoben, Austria

Glass Fiber Reinforced Polymer (GFRP) composites and their environmental challenges

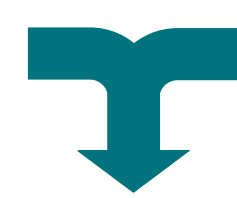
- Widely used high-performance materials
- Under sustainability paradigm environmental concerns due to:

Use of finite fossil resources

Limited material recyclability

Little available reprocessing technology

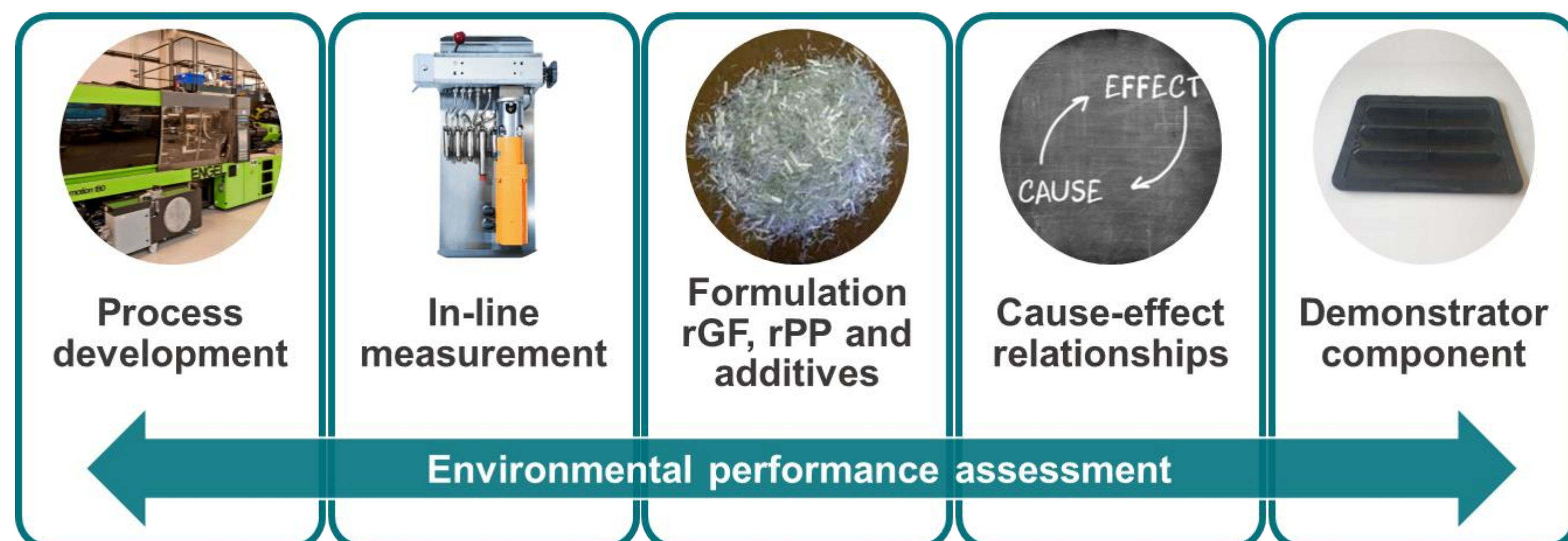
Impacts on the environment



Recycling with suitable technologies to encounter those challenges

The LightCycle project

→ Develop **injection molding compounding** as an innovative process technology for the **closed-loop and energy-efficient recycling of GFRP composites**

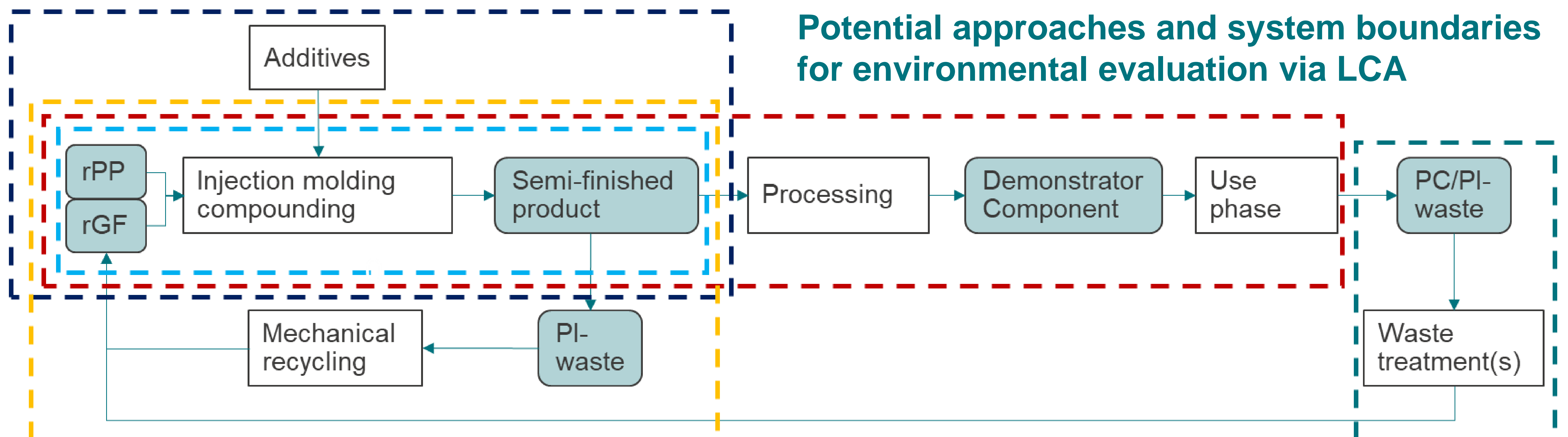


How to verify anticipated environmental benefits of GFRP composite recycling?

- Life Cycle Assessment to evaluate environmental impacts according to ISO 14 040 series
- Different potential approaches and study designs to assess the environmental impacts of the project activities via LCA

Evaluation of options	1a Virgin vs. recycled	1b Two-step vs. one-step	2 Demonstrator	3 Multiple recycling cycles	4 Role of additives	5 EoL options
Scientific relevance LCA	High Benefits of recycling and circular economy	High Lack of process evaluation	High Application examples needed	Low Little realistic, low impact	High Functional and ecological impact	Medium Own research field
Project relevance	High Material differences	High Main project benefit	High Multiple aspects covered	Medium Add-on, not integral	Medium Included project aspect	Low Not directly included
Feasibility	Medium Additional effort for virgin	High Resources available	Medium Interdisciplinarity	Medium Functional unit definition	Medium Additional data collection	Low Out of scope
Data required	Medium Data on PC recycling	Low Primary data inhouse	High Component and reference	Low Inhouse recycling	High Specific production routes	High Complex topic and treatments

Potential approaches and system boundaries for environmental evaluation via LCA



1: In reference to virgin materials or to two-step process (compounding and injection molding separately)

2: Comparison of demonstrator to industrial standard

3: Multiple recycling cycles

4: Role of additives

5: Comparison of GFRP recycling options

PROJECT: Upcycling of regenerates and injection molding into quality lightweight components using a new technological approach (LightCycle)

PROJECT PARTNERS: Montanuniversität Leoben, Engel Austria GmbH, LIT Factory der Johannes Kepler Universität Linz, Leistritz Extrusionstechnik GmbH, Gabriel Chemie GmbH

FUNDING: The Project LightCycle (project no. FO999889913) is financially supported by the Austrian Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) within the FTI initiative "Kreislaufwirtschaft 2021" and administrated by the Austrian Research Promotion Agency (FFG)



Federal Ministry
Republic of Austria
Climate Action, Environment,
Energy, Mobility,
Innovation and Technology