A material selection journey for sustainable discontinuous fibre composites

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Motivation and Aim

- Investigating the **viability** of using **sustainable** constituents within the HiPerDiF method for **circular economy**

**Fibre**
- Carbon fibres
- Glass fibres

**Polymer (Matrix)**
- Epoxy resin

- **X** renewable
- **X** easy to recycle
- **X** low environmental impact
- **X** biodegradable
- **X** sustainable

- Selection of sustainable **reinforcement materials** that is compatible for the HiPerDiF method
- Selection of sustainable **matrix material**
HiPerDiF is a water-based process has a potential to produce high performance structures by using eco-friendly, low impact, green, and renewables constituents. The main alignment mechanism is a sudden momentum change of fibre-water suspension.
Natural Fibres as a Sustainable Reinforcement Constituent in Aligned Discontinuous Polymer Composites Produced by the HiPerDiF Method

Ali Kandemir, Marco L. Longana, Tulio H. Panzera, Gilberto G. del Pino, Ian Hamerton and Stephen J. Eichhorn

Kandemir et al. Natural Fibres as a Sustainable Reinforcement Constituent in Aligned Discontinuous Polymer Composites produced by the HiPerDiF Method. Materials 2021, 14(8), 1885; https://doi.org/10.3390/ma14081885.
Selection of sustainable reinforcement materials that is compatible for the HiPerDiF method

- Carbon fibres
- Glass fibres

- Carbon fibres: renewable, easy to recycle, low environmental impact
- Glass fibres: biodegradable, sustainable

Selection of sustainable matrix material

- Epoxy resin
Selection of sustainable reinforcement materials that is compatible for the HiPerDiF method

- renewable
- easy to recycle
- low environmental impact
- biodegradable
- sustainable

- Selection of sustainable matrix materials

- Carbon fibres
- Glass fibres
- Polymer (Matrix)
Developing aligned discontinuous flax fibre composites: Sustainable matrix selection and repair performance of vitrimers

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Elium® resin from Arkema
- Advanced thermoplastic resin show mechanical properties similar to epoxy composites.
  - High impact resistance
  - Post-thermoformability
  - Recyclability
  - Material assembling possibilities

Furacure (PFA) from Bitrez LTD.
- A poly-furfural alcohol “PFA” bio-based polymers derived from biomass.
  - REACH compliant polymer
  - Bio-based grade
  - High thermal performance
  - Fire resistant

Vitrimax (Vitrimer) from Mallinda Inc.
- A new platform chemistry based on dynamically exchangeable imine-linked polymer networks.
  - Remoldability, reshaping
  - High mechanical performance
  - Covalent welding
  - Recyclability
  - Reusability

Selection of sustainable reinforcement materials that is compatible for the HiPerDiF method.

- Fibre:
  - Renewable
  - Biodegradable
  - Low environmental impact

- Polymer (Matrix):
  - Selection of sustainable matrix material
  - Easy to recycle
  - Circular economy

Future work